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LIBRARY INFORMATION PROCESSING USING AN ON-LINE, REAL-TIME COMPUTER SYSTEM.

BY- HOLZBAUR, FREDERICK W. FARRIS, EUGENE H.
INTERNATIONAL BUSINESS MACHINES CORP.

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DESCRIPTORS- *INPUT OUTPUT DEVICES, *MAN MACHINE SYSTEMS, *INFORMATION SYSTEMS, *LIBRARY TECHNICAL PROCESSES, TIME SHARING, COMPUTERS, CATALOGING, LIBRARY ACQUISITION, AUTOMATION, FEEDBACK, INFORMATION PROCESSING, INPUT OUTPUT, ELECTRONIC DATA PROCESSING, INFORMATION CENTERS, ADMINISTRATIVE TERMINAL SYSTEM (ATS), IBM 1440 COMPUTER SYSTEM,

DIRECT MAN-MACHINE COMMUNICATION IS NOW POSSIBLE THROUGH ON-LINE, REAL-TIME TYPEWRITER TERMINALS DIRECTLY CONNECTED TO COMPUTERS. THESE TERMINAL SYSTEMS PERMIT THE OPERATOR, WHETHER ORDER CLERK, CATALOGER, REFERENCE LIBRARIAN OR TYPIST, TO INTERACT WITH THE COMPUTER IN MANIPULATING DATA STORED WITHIN IT. THE IBM ADMINISTRATIVE TERMINAL SYSTEM (ATS) IS ONE OF THE SYSTEMS WHICH CAN BE USED WITH A RELATIVELY SMALL COMPUTER TO PERFORM LIBRARY PROCESSING SERVICES FOR A MULTILIBRARY SYSTEM IN A SCIENTIFIC-TECHNICAL ENVIRONMENT, AS HAS BEEN DEMONSTRATED AT IBM'S SYSTEM DEVELOPMENT LIBRARY. IN THIS LIBRARY INFORMATION IS ENTERED ONCE AT THE TIME OF ORDERING OR WHEN THE INFORMATION IS FOUND IN A BIBLIOGRAPHIC SOURCE AND THEN USED FOR ACQUIRING AND CATALOGING THE ITEM AS WELL AS FOR PRODUCING THE REQUIRED CIRCULATION CONTROL CARDS. OTHER PRODUCTS OF THE SYSTEM INCLUDE BOOK ORDERS, AN ACCUMULATIVE ORDER LIST (KEPT ONLY IN COMPUTER STORAGE), A CATALOGING WORKSHEET FOR EACH ITEM ORDERED, THREE BY FIVE UNIT RECORD CARDS, AN INDEX OF CATALOGED ITEMS, AND A LIBRARY ANNOUNCEMENT BULLETIN. ATS IS ALSO USED WITHIN THE LIBRARY FOR ABSTRACT AND TEXT WRITING AND EDITING, COMMUNICATIONS, AND STATISTICAL RECORD KEEPING. FOR ALL OF THESE APPLICATIONS, NO SPECIAL PROGRAMS HAVE BEEN WRITTEN. INSTEAD THE PROGRAM DEVELOPED FOR THE SYSTEM HAS BEEN USED SINCE IT HAS SUFFICIENT FLEXIBILITY. APPENDIX A IS THE LIBRARY PROCESSING FLOWCHARTS FOR THE SYSTEM AND APPENDIX B OUTLINES THE DATA FORMAT USED IN THE SYSTEM. THIS DOCUMENT IS ALSO AVAILABLE FREE FROM INTERNATIONAL BUSINESS MACHINES CORPORATION, SYSTEMS DEVELOPMENT DIVISION, BOX 390, DEPARTMENT A08, BUILDING 851, POUGHKEEPSIE, NEW YORK 12601 OR THE NEAREST IBM DATA PROCESSING DIVISION BRANCH OFFICE. (AUTHOR/CM)

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Technical Report

Library Information Processing Using an On-Line, Real-Time Computer System

F. W. Holzbaur, E. H. Farris

IBM SYSTEMS DEVELOPMENT DIVISION
POUGHKEEPSIE LABORATORY

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LIBRARY INFORMATION PROCESSING USING AN ON-LINE, REAL-TIME COMPUTER SYSTEM

By

Frederick W. Holzbaur
Eugene H. Farris

ABSTRACT

Direct man-machine communication is now possible through on-line, real-time typewriter terminals directly connected to computers. These terminal systems permit the operator, whether he be order clerk, cataloger, reference librarian or typist, to interact with the computer in manipulating data stored within it.

This paper details the integration of such equipment, called the IBM Administrative Terminal System, with more common computer techniques to perform library processing services for a multilibrary system in a scientific and technical environment.

While the total systems concept is still being developed, ATS has been operational in library processing for almost two years in IBM's Systems Development Division library at Poughkeepsie, New York. The program package, used for index creation and 3x5 card printing has seen over three years of service.

Emphasis is placed on acquisitions and cataloging functions but other applications such as circulation and announcement preparation, abstract and text writing and editing, communications, and statistical record keeping are discussed.

ATS
Library information systems
Terminals
03 Communications
05 Computer Application
23 Miscellaneous

IBM

International Business Machines Corporation
Systems Development Division, Poughkeepsie, New York

INTRODUCTION

IBM's Systems Development Division Laboratory at Poughkeepsie, New York, has had a number of its library operations augmented by electronic data processing machines for several years. One application, for example, the punched card circulation system, dates back to 1959, and the first computer-produced printed book catalog appeared in 1961. Development of computer techniques for library applications has been steady since then. In 1964 all book acquisitions and processing activities, including cataloging, were brought together into the Library Processing Services Department. This work also included some technical report processing.

Even though the department's area of responsibility was enlarged to serve several other IBM libraries, the new total processing volume was not enough to reduce the rather high unit cost per volume of $10+ which had been the case when only batch processing computer techniques were employed. Analysis of all aspects of the operation revealed that:

- Data conversion for computer processing, including proofreading and correction, took more time than any other operation.
- Keypunch error rate was high unless cards were verified.
- Card verification increased accuracy but doubled cycle time. Programs would not function successfully if there were any format or sequence errors in input data.

An error detection program, AUDIT, was written to detect input errors so that other programs would run successfully. Still, several reruns might be needed before data was error-free.

Obviously, the least number of initial errors in input data would result in the greatest dollar savings. Various educational and procedural techniques were attempted but keypunching as a means of data input was still the operation needing the most improvement.

The Poughkeepsie Laboratory's Systems and Procedures group first investigated the Administrative Terminal System (ATS) in 1962, while the program was being developed by IBM's Advanced Systems Development Division, San Jose, California.

ATS was originally developed with two goals in mind. The first was to bring to administrative tasks the advantages of terminals as input-output devices remotely located from the central computer. Existing terminal systems were oriented to programming and scientific computation, or else were highly specialized, such as airline reservation systems. The second goal was to keep costs as reasonable as possible in order to encourage widespread use of terminal systems in ordinary business environments. Previous time-shared systems required large central processors and high-speed random-access storage devices with large data capacities. ATS operates with several of IBM's smallest

computers, the IBM 1440/1460 systems, yet terminal response and system capabilities are comparable to those of much larger systems.

In an early ATS demonstration, we were impressed with the ease of data entry, manipulation, and correction the system provided. Printing on-line proof listings for immediate error correction was also an important benefit.

A system, combining the advantages of the electric typewriter and the desk calculator with the high-speed data manipulation ability of large-scale digital computers to produce ever-current indexes and records, would be useful to the librarian as well as the library user.

It should be emphasized that our system was experimental only in the sense that ATS had to be proven to be of advantage in a library environment. Our own management had to be satisfied that incorporating ATS into our library processing operation would result in improved cost effectiveness.

The entire cost of investigation, design, and development was borne by the department's operating budget. In the initial stages of implementation, cost per book processed increased, but was sufficiently reduced during the course of the year so that the annual budget was not exceeded. In other words, installation and use of this system was sufficiently profitable the first year so that operational savings covered all development costs, and, since both unit cost and service had to be maintained, volume was not allowed to diminish. One reason why the operation costs less than before is that system charges are now shared equally among all terminal users rather than being based solely on the volume of computation. Terminal operation has also reduced the number of batch processing operations, further reducing costs.

The rest of this paper will be organized as follows:

- Description of the Administrative Terminal System (ATS)
- General ATS capabilities
- Library processing applications of ATS
- Integration of ATS techniques with other library-oriented computer programs
- Other library applications for on-line, real-time terminal systems
- Applications outside the library for which the Administrative Terminal System has proven useful

THE ADMINISTRATIVE TERMINAL SYSTEM

The Administrative Terminal System is a real-time, multiprogrammed, time-shared, on-line, remote terminal system. Let us break this rather complex description into its component terms and examine their meanings.

Real time means that the computation takes place at the same time as the related manual operation, so that the results of the computation can be used immediately. For example, a mistake is made in typing data. The mistake is corrected by indicating the wrong word or words and entering the correct data. This replacement of incorrect with correct data is made in real time, within the computer.

Multiprogramming refers to the system's ability to handle a number of different tasks at the same time, each possibly under the control of a different program.

Time sharing is the system's ability to serve many users at the same time (or, more accurately, apparently at the same time) in such a way that each can be completely unaware of the system's use by others.

On-line indicates that an input-output device (a terminal, for example) is directly connected to the computer processor at the time data processing is apparently taking place at the remote location.

Remote terminals are input/output devices located at a distance from the computer.

ATS terminals look, and can be operated, like the IBM Selectric® typewriter, which is exactly what they were before they were modified to send and receive electrical signals. Figure 1 shows an ATS terminal in operation and Figure 2 is a diagram of a keyboard layout. The only difference between this and a standard IBM Selectric keyboard is that the Index key has been replaced with an ATTENTION key. This key makes possible all communication between the operator and the computer. Pressing the key signals the computer that the key strokes which follow are a command (rather than data to be entered), and should be so interpreted.

System Configuration

The previously stated complex definition of ATS did not cover two other important system aspects. These are the "hardware" (computing system) and the "software" (programming system).

The hardware (Figure 3) is an IBM 1440 or 1460 data processing system composed of a central processing unit, magnetic tape drives, disk

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Figure 1. ATS terminal.

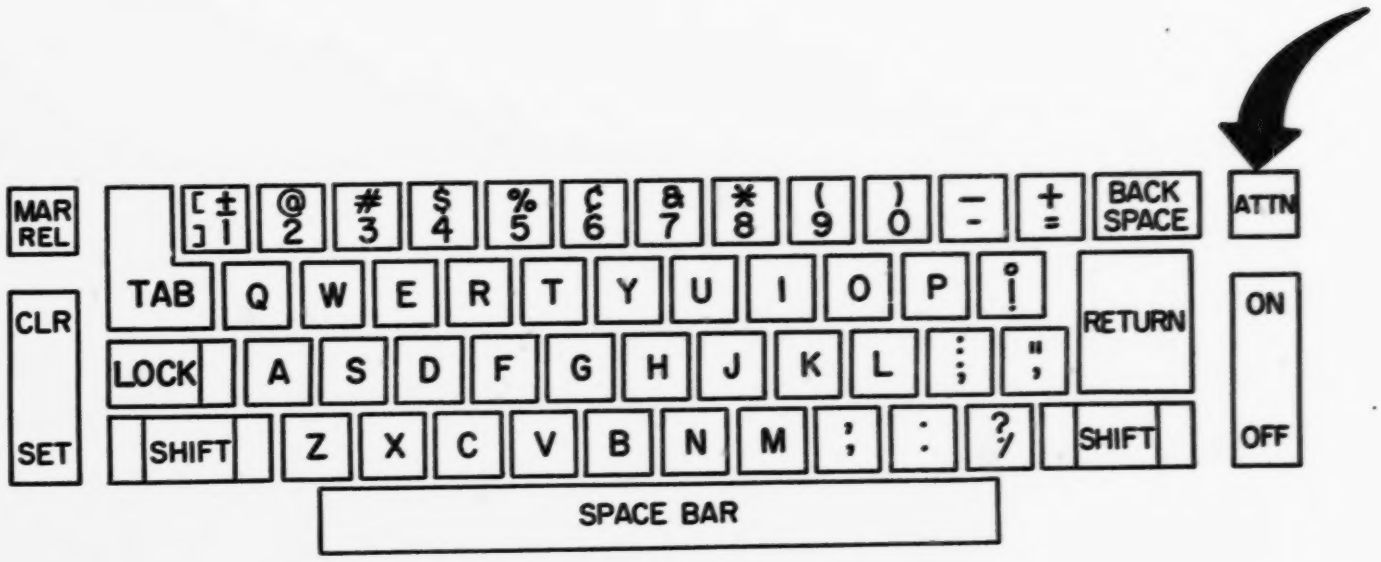

Figure 2. ATS terminal keyboard layout.

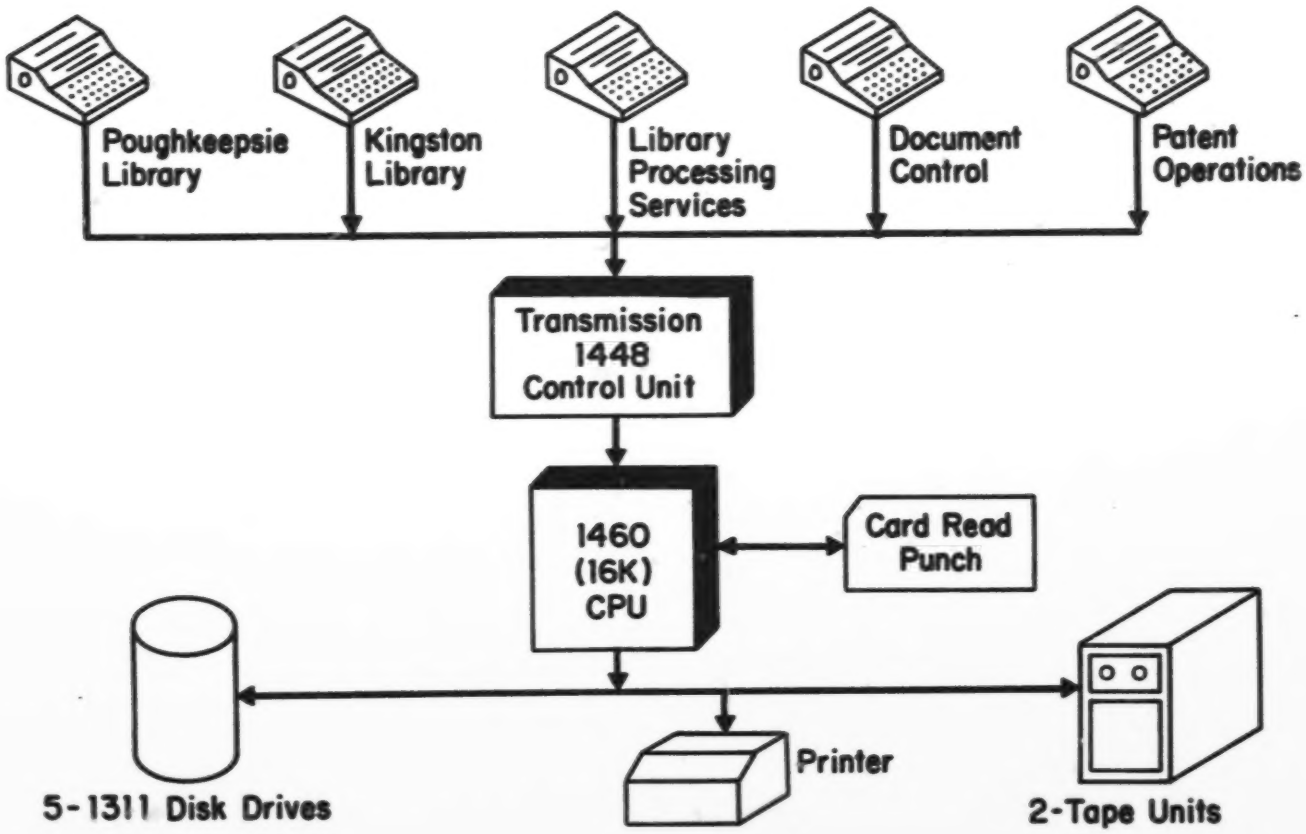

Figure 3. IBM Administrative Terminal System (components may vary in type and quantity).

storage units, card reader and punch, high-speed printers, multiplexor channels, and ATS terminals. Our system has 18 terminals on line but this can vary depending on system requirements.

Terminals are linked by leased telephone lines to the transmission control unit housing the multiplexor channels. This unit, in turn, is connected to the computer by cabling. Data flows through these channels between the terminals and the central processing unit which processes all computer operations under program control.

The ATS Programming System

The programming system consists of a control program located in core storage, and a number of service programs located in disk storage. The control program controls the transmission of data to and from one or all of the terminals, maintains lists of work in progress, handles all disk input/output operations and other "housekeeping" functions. It also calls service programs into core storage, as required by signals received from the terminals and by preprogrammed conditions.

The programming system shifts data from four types of storage, on command of the operator. These storage levels are working, permanent, archive, and message storage. Most terminal operations are conducted in working storage which is private to each terminal. Documents are stored in, and fetched from, permanent storage -- common to all terminals. While sharing permanent storage among all terminals, document quantities are limited for each user by assigning groups of document numbers. Total document size is set by limiting the amount of permanent storage capacity, expressed in "cylinders" of data, assigned to each terminal.

Security in permanent storage is maintained at three levels:

- No security -- Anyone at any terminal may retrieve, modify, and store a document at this level.
- Retrieval -- Anyone may retrieve and examine data but is prevented from modifying or deleting the original document.
- Confidential -- No one but the operator and his designees may retrieve, modify, or store the document.

Security is controlled by lockwords assigned to the document at the time the document is stored. No lockword means no security; a four-letter lockword permits retrieval only; confidential status is assured by assigning a five-letter lockword to the document.

Archive storage is basically off-line tape storage, having a lower access level in this system. It has the advantage of being virtually unlimited in capacity.

Message storage holds incoming messages until the operator wishes to receive them. Messages may be transmitted by any terminal in the system; the receiving terminal may even transmit messages to itself.

Communications

The Administrative Terminal System provides an excellent device for written communications. All terminals are interconnected through their connection with the central processor. In addition to their having common access to permanent storage (depending on the level of security), each terminal may transmit messages to any and all other terminals. ATS, then, is superior to other forms of telecommunication since the message may be corrected until perfect before it is transmitted and be formatted on receipt in a variety of ways different from the transmission format. Since this data is machine processable, it may be transmitted to other systems by punched card, magnetic tape, or by a Teleprocessing system.

It should be emphasized that the major communication advantage is not gained from the system's message capability. Rather, it is the capability of any and all terminals to have access to, and manipulate data in, all documents.

Operating Modes

The two major modes of operation are automatic and uncontrolled. Text entered in automatic (A) mode may be structured in a variety of ways as output, including a wide variation in line length and right margin justification as well as the more customary left margin alignment. (This report has been prepared on ATS primarily in automatic mode.)

Data entered in uncontrolled (U) mode will be printed as entered which is particularly desirable for computer input.

Heading (H) and footing (F) modes are used for text processing to create running headings and footings on each page.

Both automatic and uncontrolled modes may be operated in either normal mode with full system response or in a faster expert (E) mode in which the program briefly acknowledges receipt of an instruction.

Terminal operation is simpler than operating a keypunch machine. Most operations are similar to typewriting with nearly all commands (program-controlled functions) activated by a few key-strokes. A few sample ATS operations are:

In working storage

Clear working storage
Erase lines of data
Insert a new line
Move lines or sections from one place in the text to another
Erase characters or words
Bulk erase whole sections
Print all or part of data

In permanent storage

Get a document from permanent storage into working storage
Store a document
Delete a document
Replace a document with an updated version

Message operations

Transmit a message or document to one or more terminals
Receive a message and cause it to print in a variety of formats

Terminal Operation

Preparation of the terminal for operation consists of clearing working storage, establishing the mode of operation, and setting tabs. In our application, all bibliographic data is entered in uncontrolled mode (i.e., uncontrolled by any of the ATS format-structuring subroutines). This permits data to be retrieved in exactly the same format as it is entered. Setting tabs is as simple as any typewriter tab-setting operation and, like it, needs to be done only once until a change to another format is required. Since only two formats are used for all our bibliographic operations, only two tab settings are required. Setting the computer tab is done by typing a T wherever a tab is desired while setting the typewriter tab with the TAB key. Data fields are defined by dashes, a typing action simplified by the Typamatic® feature appearing on the IBM Selectric (dashes will continue to type as long as that key is depressed). In this operation only two tabs are needed -- data starts in position 1--the item number, position 60; and data type, position 73.

Another minor operation must be done once and is then forgotten -- that of determining which key will represent the numerical one (1). Depending on the Selectric typing element (type font) used, either the digit "1" key or the lower case "L" key may be used.

This entire process takes much less time to do (15-30 seconds) than it does to tell about it, yet it is essential to good terminal operation.

Book Processing Data Format

Data for book processing is organized in a format now used by a number of IBM libraries. However, there is no corporate standard for this type of data. Since much of the later manipulation of the book processing data will be by punched-card-handling machines and electronic digital computers, the organization of this data is rigid and precise. Far from being a handicap, this rigidity and precision allows a greater degree of freedom in data manipulation than would be the case if the data format were free-form or unstructured. Thus, controlled input results in controlled output and, through program flexibility, output data may be formatted in a number of different ways.

Since knowledge of punched-card-handling procedures is more widespread than knowledge of either remote terminal systems or electronic computers, it might be well to speak of the data format in its card image, using tabulating card terms. All bibliographic data is restricted to columns 1-46. A 46-column data field was not established through arbitrary choice. The forerunner of the present system, several generations removed, was based on 3 x 5 catalog cards as the end product, printed from punched cards on an IBM 407 electronic accounting machine. That operation was simplified by restricting data to the first 46 columns, since the IBM 407 printed 10 characters per inch and 4.6

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inches fitted neatly on catalog cards 5 inches wide. The book or item number appears in columns 61-72 while data type or sequence appears in columns 73-75. The item number at present is composed of a series of codes, meaningful to librarians, but not absolutely necessary. Other codes have been used for this purpose such as H. P. Luhn's code derived from a book's author, title, and publication date, still used in certain KWIC-type indexes. (A discussion of this coding technique may be found in Luhn's "Keyword-in-Context Index for Technical Literature (KWIC Index)," IBM Research, RC-127, August 31, 1959.) Actually any combination of characters will do as long as it is unique for each item, making date-derived codes and straight numeric sequences most desirable since the possibility of duplication is reduced.

Information type and sequence coding (columns 73-75) is most important. While some data processing is based, in part, on actual data (keyword indexes, for example) practically all processing is related to the information type code as follows:

Information Type	Type Code
Item Number	001
Call Number	010
Authors (Personal)	101,102,103,etc.
Authors (Corporate)	111,121,131,etc.
Title	201-249
Subtitle or Series Title	251-299
Notes	301-349
Publisher	351-399
Vendor Data (quantity, price, etc.)	401-499
Abstract	501-599
Internal Information (e.g., accounting data)	601-699
Subject Headings	701,702,703,etc.
Order Status	801-899
Holdings Records	901,918,933,etc.

Full information type codes and column assignments are listed in Appendix B for reference. Obviously, some of this data relates to bibliographic data and some to order data. Since all types of data can be readily accommodated, the system lends itself to both pre- as well as post-cataloging.

The integrated operation also permits a third choice called parallel cataloging. This process permits orders to be placed rapidly with a minimum of checking and searching as well as a minimum of time

spent cataloging after an item has been received. Parallel cataloging will be explained later.

Book Order Processing

Library Processing Services places the bulk of all book purchases with a small number of vendors; those books which must be ordered directly from the publishers go through a different initial process to be described later. Booksellers specializing in scientific, technical, and business books are used whenever possible in preference to dealing directly with publishers. Major emphasis is on service; if an item is needed urgently, telephone inquiries are made until it is located and purchased. Telephone orders are always confirmed in writing on our next regular order to that vendor. The book ordering cycle appears in Figure 4.

After book selection and holdings checking are completed, the requests pass to the order co-ordinator who indicates vendors, quantities, and other information not previously entered. He will also telephone the order to the vendor when speed is required. The requests next pass to the ATS operator who types the data on the terminal keyboard in the required format. One day's orders become the Detail Order List (DOL) (Figure 5) which is placed in permanent storage. A copy is also listed on the terminal and proofread by the co-ordinator. From this list, the operator corrects only those errors the co-ordinator has indicated but the effect is the same as if the entire DOL had been retyped.

A standard, individually tailored vendor heading is called into working storage from permanent storage. The same is done with the DOL and the order is "built" in this manner. Data not intended for the vendor (e.g., subject headings) are deleted.

The order (Figure 6) is printed on plain bond paper and mailed to the vendor. Then the order records are filed by adding the Detail Order List (DOL) to the Accumulative Detail Order List (ADOL), an operation requiring only a few seconds to perform. From this point on, the full order information is available to anyone having access to a terminal. The information is stored in such a manner that anyone except the designated ATS operators may query it without being able to change any of it. The order is stored, usually for a week or two, until the vendor has had time to receive it. The document containing it is then deleted.

Direct Orders

Direct orders are orders for books which cannot be placed with a wholesaler or jobber but must instead be placed directly with the publisher or his designated distributor. Such an order was formerly placed by what we call a "bill-us" letter because it bore a statement to the effect that if the total cost of the items ordered was below a specified limit, the vendor was to ship the item and bill us for it. Continued use of a letter form was thought to be more desirable than using some standard purchase requisition. However, the order letter would have to contain all the elements of a purchase order in addition to the required bibliographic information. Also, data entered on the direct order letter had to be fully compatible in format and structure with the data format established for the regular order operation.

These various requirements were met by printing the form letter with the standard purchase order information such as the "ship to" and

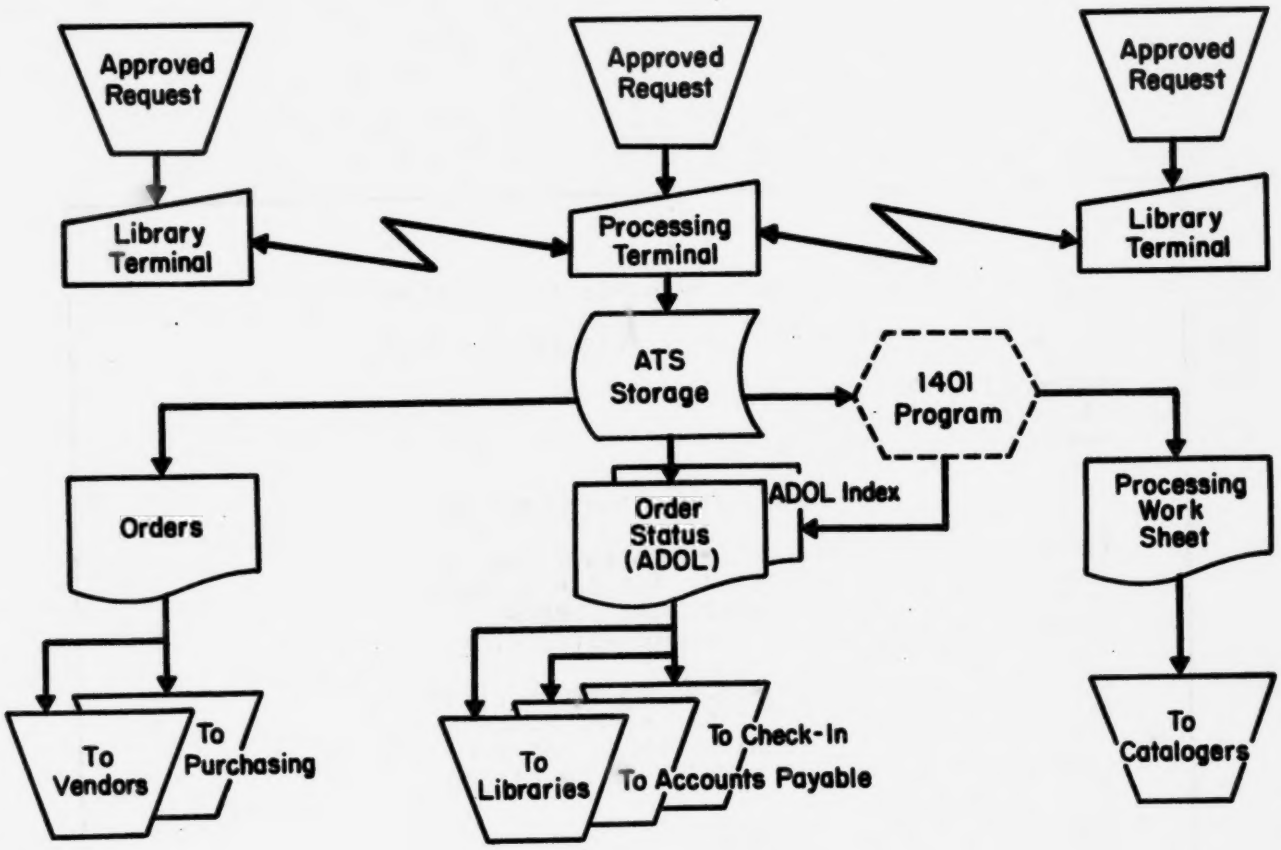

Figure 4. Library processing book order cycle.

```
64ßßß2  RELEASE  19                                          33ß2  64ßßß2ß1
JONES, PETER                                                        1ß1
  THE TECHNIQUE OF THE TELEVISION CAMERAMAN.¶                       2ß1
MORGAN AND MORGAN, INC., HASTINGS-ON-HUDSON,                        351
NEW YORK                                                            352
QUANTITY 1 COP  $ 1ß.ßß                                             4ß1
1 COP 31-69-ß456-ß1-ß-357-5ß7                                       6ß1
D/C ADAMS, L       D 5ß7      B KGN                                 6ß2
64ßßß3  RELEASE  19                                            33ß2  64ßßß3ß1
MILLERSON, GERALD                                                   1ß1
  THE TECHNIQUE OF TELEVISION PRODUCTION.¶                          2ß1
MORGAN AND MORGAN, INC., HASTINGS-ON-HUDSON,                        351
NEW YORK                                                            352
QUANTITY 1 COP  $ 1ß.ßß                                             4ß1
1 COP 31-69-ß456-ß1-ß-357-5ß7                                       6ß1
D/C ADAMS, L B     D 5ß7      B KGN                                 6ß2
64ßßß4  RELEASE  19                                            33ß2  64ßßß4ß1
WILSON, ALAN HERRIES                                                1ß1
  THERMODYNAMICS AND STATISTICAL MECHANICS.¶                        2ß1
495P.                                                               2ß2
1966, CAMBRIDGE UNIVERSITY PRESS, CAMBRIDGE                         351
QUANTITY 3 COP                                                      4ß1
1 COP 653                                                           6ß1
2 COP A26                                                           6ß2
THERMODYNAMICS                                                      7ß1
STATISTICAL MECHANICS                                               7ß2
918          QC 311.    .W5  /1966/                                918
933          QC 311.    .W5  /1966/                                933
```

Figure 5. Detail Order List (DOL) typed from request.

INTERNATIONAL BUSINESS MACHINES CORPORATION

LIBRARY BOOK ORDER OCTOBER 31, 1966

BUSINESS BOOKSTORE, INC.
292 EAST 23RD STREET
NEW YORK, NEW YORK 1ØØ1Ø

PURCHASE ORDER NO. LJV 7222 RELEASE 2Ø

ITEMS LISTED ON THIS ORDER INDICATE THE QUANTITIES TO BE SHIPPED TO THE IBM SYSTEMS DEVELOPMENT DIVISION LABORATORY LIBRARY PROCESSING SERVICES IN POUGHKEEPSIE, N. Y.

ALL CORRESPONDENCE IN REGARD TO ITEMS LISTED ON THIS ORDER SHOULD REFERENCE THE PURCHASE ORDER NUMBER, THE RELEASE NUMBER, AND THE ITEM NUMBER UNDER WHICH THE BOOK IS LISTED.

SHIP TO:	INVOICE TO:
IBM CORPORATION	IBM CORPORATION
P.O. BOX 39Ø	P.O. BOX 39Ø
POUGHKEEPSIE,	POUGHKEEPSIE,
NEW YORK 126Ø2	NEW YORK 126Ø2
ATTN-LIBRARY PROCESSING SER	ATTN-LABORATORY ACCTS PAYABLE
DEPT A26 BLDG 7Ø1	DEPT A32 BLDG 991

6441Ø1 RELEASE 2Ø
BROWN, A
MARCO, S M
INTRODUCTION TO HEAT TRANSFER.# 3RD.ED.
1958, MCGRAW-HILL, NEW YORK
QUANTITY 5 COP
CONFIRMATION ORDER ONLY - TELEPHONED 1Ø-2Ø-6Ɛ

6441Ø2 RELEASE 2Ø
KITTELL
INTRODUCTION TO SOLID STATE PHYSICS.#
3RD.ED.
1966, WILEY, NEW YORK
QUANTITY 1 COP

6441Ø3 RELEASE 2Ø
COLLEGE CHEMISTRY.#
SCHAUM PUBLISHING CO., NEW YORK
QUANTITY 2 COP $ 2.5Ø

6441Ø4 RELEASE 2Ø
COLLEGE ALGEBRA.#
SCHAUM PUBLISHING CO., NEW YORK
QUANTITY 2 COP $ 2.5Ø

Figure 6. Purchase order.

"bill to" addresses, authorizing signature, and statement of order conditions. The master for printing the form letter was prepared using the same Selectric type element that would be used to fill in the order data, assuring uniformity of appearance throughout the form letter. (Since the ATS terminal may function as an automatic typewriter, form portions of the letter could well have been printed on-line. Preprinting the forms on letterhead stationery saves operator time.)

All order information destined for the vendor is first typed, proofread, and only corrections retyped. Format is exactly the same as that of regular orders with the addition of the vendor's name and address in each entry. This information would most logically be placed in the vendor data category. However, since inside addresses usually precede the message, the vendor's address is placed in category 0xx, assuring proper sequence without need for a restructuring program. Stop codes, which cause the ATS to stop printing, are also entered after categories 0xx and 4xx.

After the preliminary work is completed the preprinted form letters are fed into the terminal. The stop codes permit the operator to insert the current date, move to the inside address and bibliographic data, and change sheets between entries. No letters ever have to be retyped since there are no errors at this stage. Further keypunching and verifying are also unnecessary, since the data, augmented by confidential information (which may be entered at any time), are already in the proper format for inclusion in the order status listings and indexes. Addressing of envelopes is made unnecessary by the use of window envelopes.

If ordered items aren't received after a suitable interval, claim letters are readily prepared by using an appropriately worded form letter formatted like the order letter, and containing necessary data from the direct order section of ADOL.

Accumulative Detail Order List (ADOL)

The Accumulative Detail Order List (ADOL) (Figure 7), is the primary record of items ordered. As such it is kept constantly updated in the system's permanent storage where it is immediately accessible from any terminal in the network. Organization of data in ADOL is similar to the data format previously explained under Book Processing Data Format. All information concerning an item on order is added, including communications to and from vendors, as well as dates for claiming, cancellation, receiving, and completion of processing. If items are to be parallel-cataloged, this information is added prior to the listing of cataloging work sheets.

ADOL data is copied weekly on tape and processed by the INDEX program which generates a keyword-out-of-context index, known as the ADOL index (Figure 8). The INDEX program selects every "significant" word in every data type specified, and establishes output format. The output is then sorted by index term. Another program, called TWOUP (two-up), prints the sorted words, together with the lines, or context, in which they appeared, and, for reference back to the ADOL entry, the item identification codes. A word's significance is determined by its absence from a stop list (i.e., words prevented from indexing) and whether it has passed the word-length limitation test. The word-length test is variable for each class of data; the stop list is not. Any data type, however, may or may not be indexed at the option of the requester, and index parameters may be changed from week to week. A copy of the

```
628ØØ5  RELEASE  13                                    33Ø2  628ØØ5ØØ1
WHITE, D R J                                                    1Ø1
  RFI/EMI A HANDBOOK ON TEST METHOD AND                         2Ø1
PROCEDURES FOR AUTO EMI MEASUREMENTS.Ø                          2Ø2
1966, WHITE ELECTROMAGNETICS, ROCKVILLE,                        351
MARYLAND                                                        352
QUANTITY 2 COP                                                  4Ø1
1 COP 653                                                       6Ø1
1 COP 31-61-4654-18-Ø-4Ø8-536-Ø1                                6Ø2
D/C FREEMAN, R K     D 536     B KGN                            6Ø3
ØØØ266 NYP DUE SEP                                              6Ø4
628Ø18  RELEASE  13                                   33Ø2  628Ø18ØØ1
HOPKINSON, SHIRLEY LOIS                                         1Ø1
  INSTRUCTIONAL MATERIALS FOR TEACHING THE                      2Ø1
USE OF THE LIBRARY, A SELECTED, ANNOTATED                       2Ø2
BIBLIOGRAPHY OF FILMS, FILMSTRIPS, BOOKS AND                    2Ø3
PAMPHLETS, TESTS AND OTHER AIDS.Ø                               2Ø4
1966, CLARMONT HOUSE, SAN JOSE, CALIF.                          351
QUANTITY 1 COP                                                  4Ø1
1 COP A26                                                       6Ø1
LIBRARIES --BIBLIOGRAPHY                                        7Ø1
LIBRARY SCIENCE --BIBLIOGRAPHY                                  7Ø2
REC 1 Ø83Ø66                                                    8Ø1
933         Z 666.   .H6  /1966/                               933
628Ø19  RELEASE  13                                   33Ø2  628Ø19ØØ1
CAREY, R J P                                                    1Ø1
  FINDING AND USING TECHNICAL INFORMATION.Ø                     2Ø1
153P.                                                           2Ø2
1966, EDWARD ARNOLD, LONDON                                     351
QUANTITY 2 COP                                                  4Ø1
1 COP A26                                                       6Ø1
1 COP 653                                                       6Ø2
COMMUNICATION IN SCIENCE                                        7Ø1
COMMUNICATION OF TECHNICAL INFORMATION                          7Ø2
RESEARCH                                                        7Ø3
RESEARCH, INDUSTRIAL                                            7Ø4
REC 2 Ø83Ø66                                                    8Ø1
933         Q 223.   .C3  /1966/                               933
```

Figure 7. Accumulative Detail Order List (ADOL).

ADOL INDEX, WEEK

INDEX TERM	REPLACED BY ASTERISK IN CONTEXT.	DOCUMENT NO.	
COMIT	INTRO TO * PROGRAMMING.	3302	635161
COMMAND	SYSTEM FOR * AND CONTROL APPLICA	3300	632709
COMMERCE	WORLD WHOS WHO IN * AND INDUSTRY	3309	622929
COMMERCIAL	BOARD PER * STANDARD CS 236	3300	613730
COMMISSION	STATISTICAL *, STATISTICIANS	3300	635709
COMMITTEE	* ON COLORIMETRY, AMERICA	3300	637135
COMMONWEALTH	* WELDING CONFERENCE	3302	636047
COMMONWEALTH	OF THE SECOND * WELDING CONFEREN	3302	636047
COMMUNICATE	HOW ANIMALS *.	3302	630012
COMMUNICATIN	* TECHNICAL INFORMATION, SOLUTIO	3303	612141
COMMUNICATIO	* SYSTEM ENGINEERING HANDBOOK.	3302	616014
COMMUNICATIO	AND ITS EFFECT ON *.	3302	634060
COMMUNICATIO	* SCIENCES AND LAW.	3302	636019
COMMUNICATIO	*, PATTERNS AND INCIDENTS.	3302	634083
COMMUNICATIO	ADVANCES IN * SYSTEMS.	3302	636025
COMMUNICATIO	OF COHERENT *.	3302	638027
COMMUNICATIO	DATA * IN BUSINESS, AN INTRODUCT	3302	638024
COMMUNICATIO	* SYSTEMS AND TECHNIQUES.	3303	620133
COMMUNICATIO	GRAPHICS IN *.	3302	635167
COMMUNICATIO	SYSTEMS AND *.	3302	635160
COMMUNICATIO	ASPECTS OF * NETWORKS.	3300	604707
COMMUNICATIO	ASPECTS OF * NETWORKS	3300	616702
COMMUNICATIO	9TH NATIONAL * SYMPOSIUM RECORD	3300	613725
COMMUNICATIO	OPERATION, * TECH. PLANNING.	3300	633708
COMMUNICATIO	DISCRETE * CHANNELS WITH MEMORY.	3300	635701
COMMUNICATIO	IEEE * CONVENTION	3300	637718
COMMUNICATIO	ADAPTIVE *, INFORMATION THEORY	3300	637718
COMPANIES	DIRECTORY LISTING * AND OFFICIAL	3309	622931
COMPATIBILIT	* ABSTRACTS.	3300	633704
COMPLETE	THE * PHOTOGRAPHER.	3302	638035
COMPLETE	SECRETARYS * MODEL LETTER HANDBO	3302	638021

Figure 8. ADOL index.

order index is distributed to each area concerned, together with a copy of ADOL. Recipients are each of the libraries serviced, as well as the Laboratory Purchasing and Accounts Payable departments.

Entries are kept in ADOL for about a month after an item is closed out, either through cancellation or completion of processing. The entries are then shifted, through terminal operation, to a "Filled File" maintained in archive storage. Deleting an entry from ADOL removes it from order index input so that all references to it are deleted from the next printing of the index as well. The Filled File is indexed similarly, but at longer intervals.

Our early thinking was to distribute copies of the index only and refer to ADOL on-line through the ATS terminals. We soon found the Library terminals to be in constant use for data input and manipulation and not immediately accessible when the ADOL information was required. As available terminals are almost constantly in use for data input, manipulation and on-line bibliographic output, little experience has been gained in terminal use for on-line data retrieval as a normal process. So far, there have been no terminals in our system to spare for such a stand-by operation.

ADOL listings and indexes are updated and distributed frequently enough to be satisfactory in all but the most urgent cases. These cases demand immediate action by the order co-ordinator, in any event. He first checks the receiving clerks' hand-annotated copy and, if there is no recent entry, telephones the vendor for current order status information.

Book Receiving

The cataloging cycle is outlined in Figure 9. Vendors are asked to refer to the 6-digit item number when responding to an order. All interim vendor reports also reference this number, allowing vendors to skimp on other identifying data. Since the number appears on the packing slip, the receiving clerk can turn directly to the entry in his copy of ADOL without using the ADOL index (necessary in only a few cases when the number is omitted). Date and quantity received are written by hand on the ADOL listing. This annotated listing is periodically given to the terminal operator who updates the appropriate section of ADOL with this, and other, order status information.

A previously computer-prepared cataloging worksheet (Figure 10) is removed from a file, inserted in the document, and both are passed on to the cataloging department. The worksheet contains full information on each title as it appears in the most recent ADOL; that is, what is known about an item at the time of order as well as all other information obtained subsequently (e.g., from the National Union Catalog or Library of Congress catalog card proof slips). This continually updated record permits the bulk of the bibliographic searching to be done while the item is on order, thus eliminating most processing delays associated with both pre- and post-cataloging. Any parallel cataloging must, of course, be done before the cataloging worksheets are printed or the data will not appear on them.

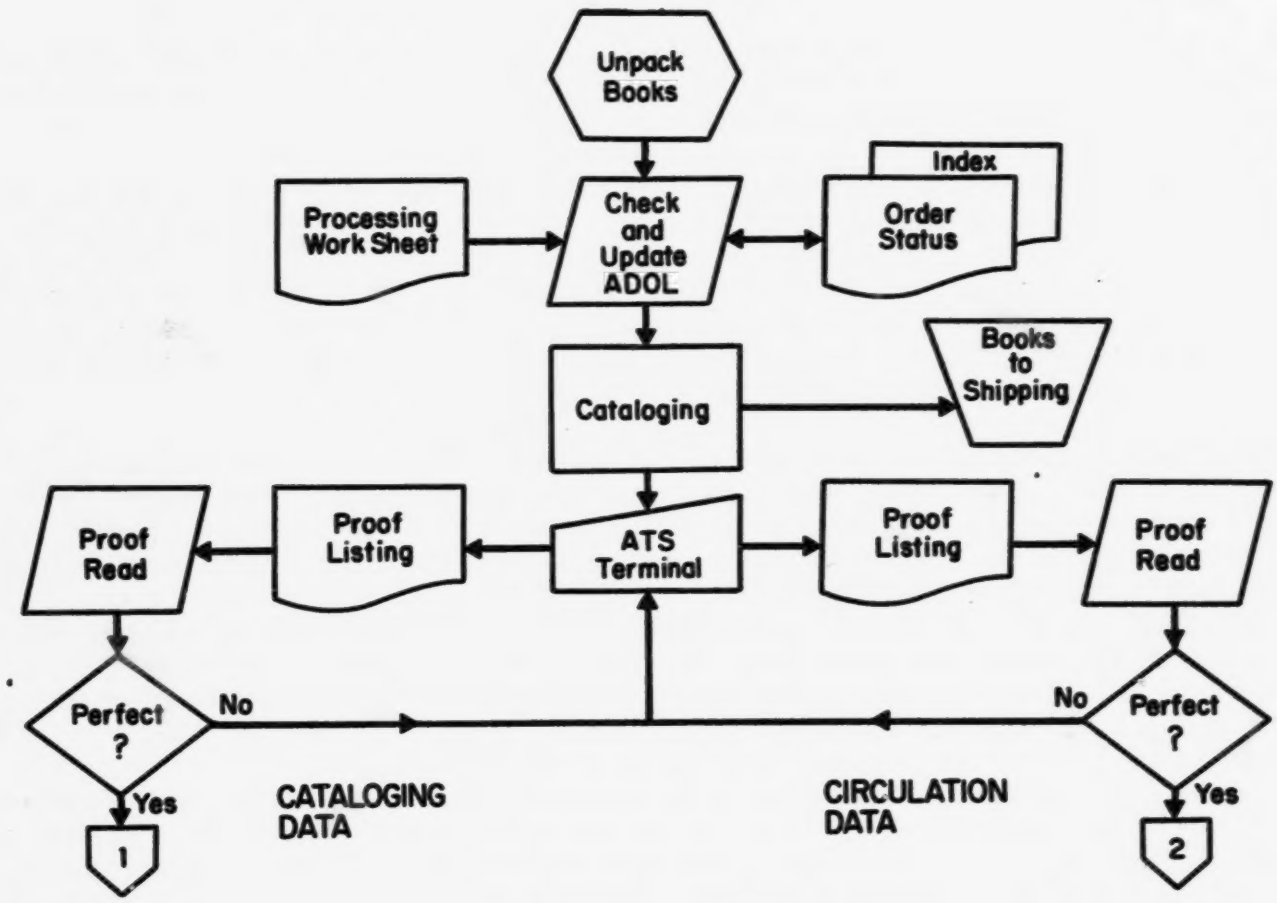

Figure 9. Cataloging cycle.

LIBRARY BOOK DATA WORKSHEET

3300 637703

ENGINEERING SEMINAR ON NEW INDUSTRIAL
TECHNOLOGIES

LASER WELDING AND MACHINING. PAPERS.= 156P.

1966. DEPT. OF INDUSTRIAL ENGINEERING AND
CONTINUING EDUCATION. UNIVERSITY PARK.
PENNSYLVANIA

2 COP A26
1 COP 653
SEE ORG CAT
1 COP 466

LASERS --CONGRESSES
ELECTRIC WELDING

918 TK7872.L3 .E5 /1965/

933 TK7872.L3 .E5 /1965/

- 207 -

Figure 10. Computer-prepared cataloging worksheet.

Cataloging

By means of the work sheet, the cataloger has on record all available information concerning an item. Some of this must be crossed out, or ignored, as it pertains only to the order cycle. Books not ordered through this system obviously do not have a computer-prepared worksheet. For these items a structured worksheet is used for hand-recording cataloging information (Figure 11.) After examining the book, the cataloger may add or change any portion of the entry he desires. If the original bibliographic information is obtained from the Library of Congress, the usual practice is to increase the number of authors, as indicated in the book (both personal and corporate) and subject headings. Restrictions limiting the number of entries where bibliographic records are manually or individually produced are not as stringent in our operation. The limits set by the data format are nine personal authors (and/or editors, translators, compilers, etc.), nine corporate authors (or corporate affiliations of personal authors, if significant), and any practical number of subject headings/descriptors/key terms, although entries are usually less than a dozen, sufficient for most subject analysis.

Information to be placed on the unit record circulatior card is also indicated in this operation. Cataloging data is then given to the terminal operator who proceeds to type it into working storage in a manner similar to the order operation. Indeed, format and typing instructions are exactly the same. After the data has been entered, proof listings are printed, usually off-line by high-speed printers (so as not to tie up the terminal unduly), and given to the catalogers to proofread. Errors are corrected and staff differences of opinion worked out. The marked proof lists are then returned to the terminal operator for updating. This cycle is repeated until the cataloging supervisor or manager is satisfied that the input is as perfect as possible.

Output Processing

Further data manipulation is now performed on the IBM 1401 data processing system by the library processing programs. (This group of programs is not part of the ATS program system, nor are they normally run on the ATS computer system.) Various forms in which the cataloging data appear are in Figure 12.

The AUDIT program, under control of SUPVS (Supervisor), as are all the programs referred to in this section, detects all format and sequence errors which may cause problems in further processing. The other programs cannot ignore errors. All indicated errors are corrected and the data batch is resubmitted to be run against AUDIT which, in addition to being an error detection program, also updates and corrects records in this format. Data is then run against PRINT, a generalized printing program, which in this case is formatted to print the master plate for the library announcement bulletin (Figure 13).

Library 3 x 5 catalog cards are next prepared using two programs called THREE and FIVEP (Figure 14). Without detailing the process, the result is a full set of catalog cards, one for each author, title, series title, subject heading and one shelf card, each with added entry (as appropriate) and call number at the top. Each card also bears the full processing number as well as indications of the IBM libraries holding the item. These are shown by three letter abbreviations; viz., BUR for Burlington, KGN for Kingston, and POK for Poughkeepsie. Cards are not printed in sets but instead are printed presorted, ready for

IBM
623-1525-2

LIBRARY BOOK DATA RECORDING WORKSHEET

SDD LIBRARY PROCESSING SERVICES

SHEET 1 OF 1

CALL NUMBER

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
H	C		1	0	6	•	5	•	M	3	6		6	5						1

(A A A) — CALL NUMBER | YEAR | VOL | COPY

CONTROL CODE

61	62	63	64	65	66	67	68	69	70	71	72
LOC		VR		CATEGORY		YR	WEEK		SEQ NO		
3	3	0	6	2	3	6	3	9	5	4	5

SHELF KEY — VOL PT

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	73–75
H	C		1	0	6	•	5		•	M	3	6		/	1	9	6	5	/																											-	010

PERSONAL AUTHOR(S) — 46 | 59 | 73–75

		101

CORPORATE AUTHOR(S) — 46 | 59 | 73–75

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.		111
ALUMNI SEMINAR, 1965		112

TITLE — 46 | 59 | 73–75

/ OUTLOOK ON MAN'S FUTURE.# 76P.		201

SOURCE — 46 | 59 | 73–75

1966, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, OFFICE		351
OF PUBLICATIONS, CAMBRIDGE		352

SUBJECT HEADINGS — 46 | 59 | 73–75

FORECASTS		701
U.S. -- ECONOMIC CONDITIONS --1945-		702
U.S. -- POLITICS AND GOVERNMENT --1945-		703
POPULATION		704

HOLDINGS — VOL PT — 46 | 59 | 73–75

918	HC 106 • 5 • M36 / 1965 /		918
933	HC 106 • 5 • M36 / 1965 /	-	933
	• • / 19 /		
	• • / 19 /		

1 3 13 19 23 28 33 36 40

Figure 11. Book data recording worksheet.

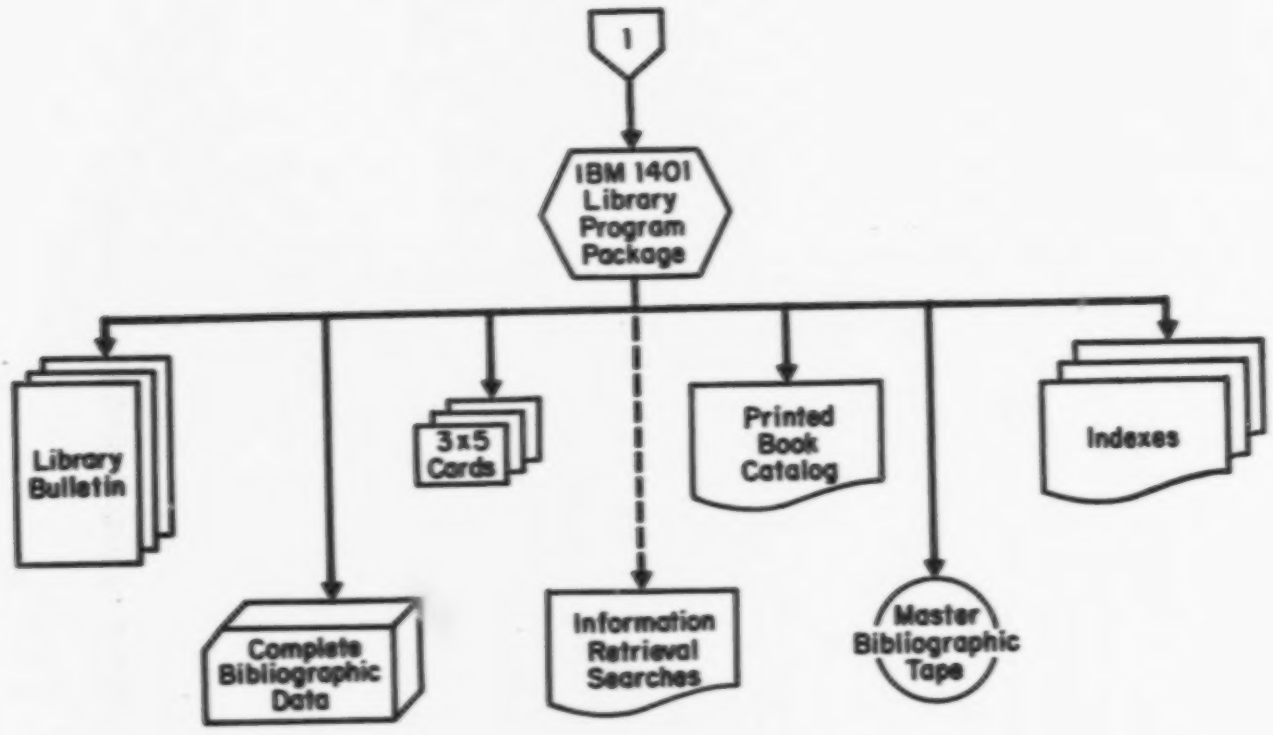

Figure 12. Forms of cataloging data output.

BOOKS LISTED BY CATEGORY

JENNISON, R C
FOURIER TRANSFORMS AND CONVOLUTIONS FOR THE EXPERIMENTALIST.# 120P.

1961, PERGAMON PRESS, NEW YORK

918 QA 403. .J4 /1961/
933 QA 403. .J4 /1961/

20 PHYSICS

FRIDKIN, VLADIMIR MIKHAILOVICH
ZHELUDEV, IVAN STEPANOVICH
TYBULEWICZ, A /TR/
PHOTOELECTRETS AND THE ELECTROPHOTOGRAPHIC PROCESS.# 195P.

AUTHORIZED TRANSLATION FROM THE RUSSIAN
1961, CONSULTANTS BUREAU, NEW YORK

918 QC 585. .F68 /1961/
933 QC 585. .F68 /1961/

COX, ARTHUR
PHOTOGRAPHIC OPTICS.# 13TH. ED. 490P.

A MODERN APPROACH TO THE TECHNIQUE OF DEFINITION
1966, FOCAL PRESS, NEW YORK

918 TR 220. .C6 /1966/
933 TR 220. .C6 /1966/

Figure 13. Library announcement bulletin.

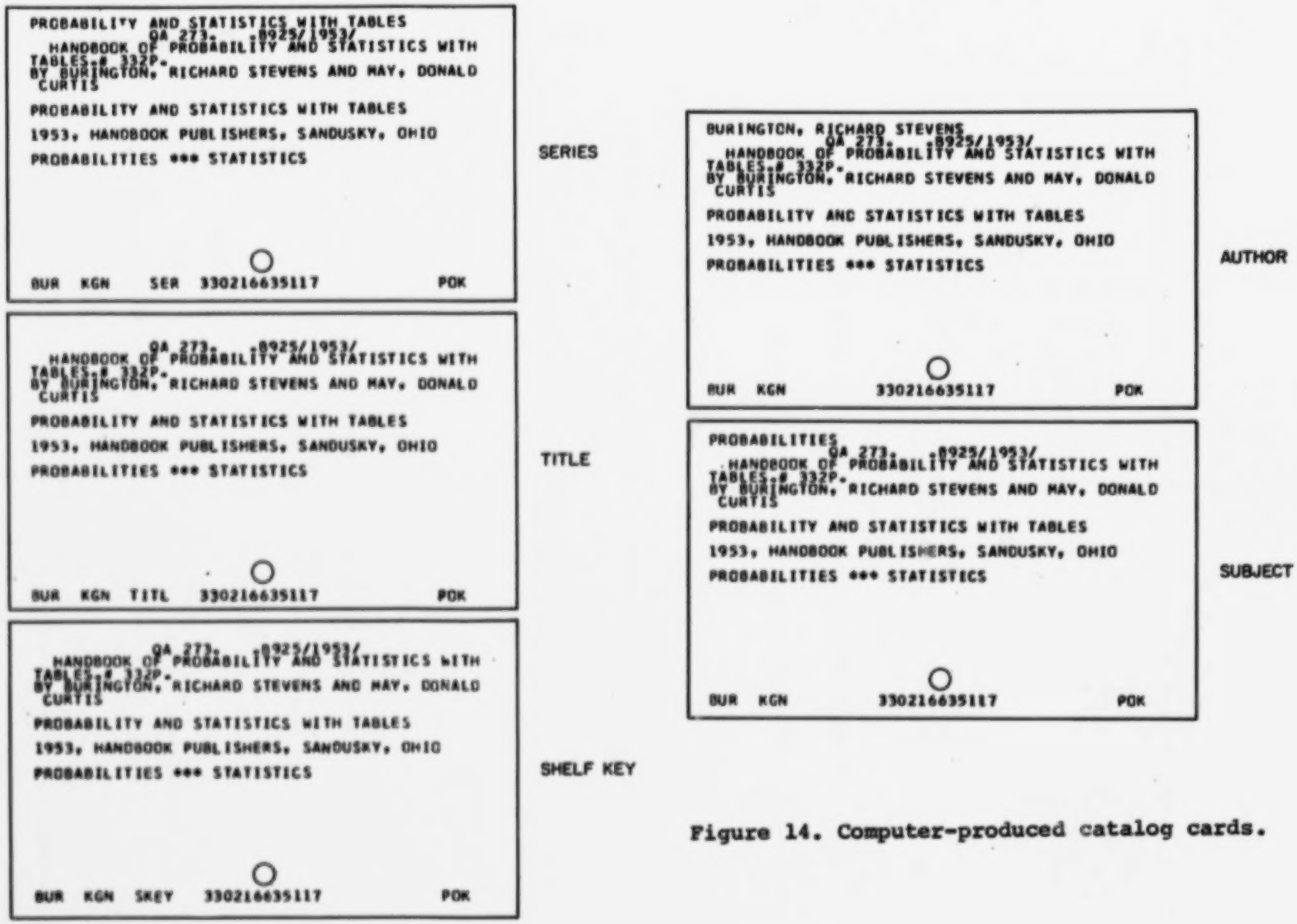
PROBABILITY AND STATISTICS WITH TABLES
QA 273. .8925/1953/
HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES.# 332P.
BY BURINGTON, RICHARD STEVENS AND MAY, DONALD CURTIS
PROBABILITY AND STATISTICS WITH TABLES
1953, HANDBOOK PUBLISHERS, SANDUSKY, OHIO
PROBABILITIES *** STATISTICS
BUR KGN SER 330216635117 POK
SERIES
BURINGTON, RICHARD STEVENS
QA 273. .8925/1953/
HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES.# 332P.
BY BURINGTON, RICHARD STEVENS AND MAY, DONALD CURTIS
PROBABILITY AND STATISTICS WITH TABLES
1953, HANDBOOK PUBLISHERS, SANDUSKY, OHIO
PROBABILITIES *** STATISTICS
BUR KGN 330216635117 POK
AUTHOR
QA 273. .8925/1953/
HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES.# 332P.
BY BURINGTON, RICHARD STEVENS AND MAY, DONALD CURTIS
PROBABILITY AND STATISTICS WITH TABLES
1953, HANDBOOK PUBLISHERS, SANDUSKY, OHIO
PROBABILITIES *** STATISTICS
BUR KGN TITL 330216635117 POK
TITLE
PROBABILITIES
QA 273. .8925/1953/
HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES.# 332P.
BY BURINGTON, RICHARD STEVENS AND MAY, DONALD CURTIS
PROBABILITY AND STATISTICS WITH TABLES
1953, HANDBOOK PUBLISHERS, SANDUSKY, OHIO
PROBABILITIES *** STATISTICS
BUR KGN 330216635117 POK
SUBJECT
QA 273. .8925/1953/
HANDBOOK OF PROBABILITY AND STATISTICS WITH TABLES.# 332P.
BY BURINGTON, RICHARD STEVENS AND MAY, DONALD CURTIS
PROBABILITY AND STATISTICS WITH TABLES
1953, HANDBOOK PUBLISHERS, SANDUSKY, OHIO
PROBABILITIES *** STATISTICS
BUR KGN SKEY 330216635117 POK
SHELF KEY

Figure 14. Computer-produced catalog cards.

sequence filing in a divided catalog. They are also printed on predrilled card stock "two-up," i.e., side-by-side, so that by slitting the cards vertically, two identical sets are prepared simultaneously. The printing operation is repeated until enough sets have been printed. A program modification prints only one set at a time, if desired, but computer costs are about the same, whether one or two sets are printed.

INDEX

Indexes of cataloged items are prepared periodically using the INDEX program, the same program used to index order status information. These indexes are used in conjunction with bibliographic listings which may or may not be formatted by the PRINT program. INDEX is a permutation-indexing program similar to KWIC-type programs, but has certain advantages over them. Notably, in the printed format (Figure 15), removing the indexed term from its context and listing it in alphabetical order along the left margin of each column has definite advantages for manual (i.e., visual) retrieval. The context advantages of KWIC indexes aren't lost since the context, with the indexed word replaced by an asterisk, immediately follows the word.

Experience indicates that indexes for larger groups of data are easier to use if they are divided; that is, if separate author, title, and subject indexes are listed rather than combined in one alphabetic sequence. One advantage is that separate stop lists, and word-length exclusion criteria may be prepared for each category -- a desirable feature since each category has different word characteristics. A stop list tailored to suppress meaningless words in corporate authors might be ineffective (or potentially harmful) when applied to subject headings. Also, suppressing three-letter words in title permutation indexes would keep down the number of words required in a stop list. Applied to an author index, such a word-length limitation would only exclude names of people having surnames of that length. A two-letter minimum suppresses single-letters from indexing without the need for placing the entire alphabet on the stop list. This is a valuable, time-saving program feature. A preliminary match against the word-length test, and rejection, eliminates the need for individual program comparison of each word being indexed with every word on the stop list.

An added capability of the INDEX program is that the logic can be reversed so that any words on the stop list become search terms. In this mode of operation the INDEX program is called SEARCH. As one may have suspected by now, visually searching the printed indexes is generally faster and just as satisfactory as running data against the SEARCH program.

Library Bulletin

It has been mentioned that bibliographic data is run against the PRINT program to produce a library bulletin. This is produced from the same ATS input data from which the 3 x 5 cards, the printed book catalog, and the indexes are prepared. When the PRINT program is used, format is structured to facilitate reading, unlike the other formats which emphasize ease of look-up and retrieval. The bulletin is produced twice monthly and contains most of the books cataloged during the preceding semimonthly period. Books are arranged by broad subject categories to facilitate browsing. A Current Awareness section announcing periodical articles, also by subject categories, is included. Distribution is to all IBM Systems Development Division employees desiring copies, particularly those served by the libraries for whom we process books, and to other IBM libraries.

INDEX TERM	REPLACED BY ASTERISK IN CONTEXT.	DOCUMENT NO.
GLINER	KOSHLIAKOV, SMIRNOV, *,	933241640022
GLOBAL	SYMPOSIUM ON * COMMUNICATIONS	933640310711
GODESBERG	OF TRANSLATORS, BAD *,	933642311108
GOETZ	WOODS, BERRY, *,	933642326102
GOLD	KNOX, *,	933342048038
GOLDBERG		933341648059
GOLDBERG	*, VACCARO, SYMPOSIUM ON THE	933642223403
GOLDBERG	*, VACCARO, SYMPOSIUM ON THE	933642212699
GOLDEN		933252130020
GOLDFARB	*, INSTITUTE OF ELECTRICAL AND	933640926101
GOLDFARB	*, KAISER,	933241343023
GOLDFARB	*, INSTITUTE OF ELECTRICAL AND	933250930030
GOLDHOR	*, ILLINOIS UNIVERSITY. LIBRARY	933642314302
GOLDMAN	*, SLATTERY,	933252214021
GOLDSTEIN	VON MISES, FRANK, *, KAC,	933341641113
GOLDSTEIN		933632332613
GOLDWASSER		933252014006
GOLENPAUL	GOLENPAUL, * /	933632310002
GOLENPAUL	*, GOLENPAUL /	933632310002
GOLLOB	BELOV, ITZKOFF, *, HOLSER,	933342038104
GOLOMB	*, SHANKS,	933251621019
GOLOMB	*, BAUMERT, EASTERLING, STIFFLER	933250301030
GOLUBEV	*, SHORR-	933641621602
GONDA	*, MARSH, LOUIS, OCCUPATIONAL	933632301506
GONZALEZ	MCMILLAN, *,	933250526022

Figure 15. Author index of cataloged items.

Unit Record Preparation

Despite the number of installed computer applications, unit records still play a significant role in the operations of our libraries. As previously mentioned, the circulation systems are based on a unit record card system and our unit record-based Catalog of Books is still popular. While use of the data differs at the several locations (circulation systems vary with local customs and library size), the input format remains the same.

Use of circulation and holdings information prepared during the cataloging cycle (Figure 9) is shown in Figure 16.

ATS has proven to be an excellent substitute for keypunching as a data input medium. Data may be prepared with proper peripheral equipment from ATS input, either for use as low-cost, low-level data storage media or as input to other systems requiring data in these forms. Consequently, all unit records are prepared on the ATS terminal and cards are supplied to us as an off-line service. Figure 17 is an example of data representing a group of books as they are entered on the terminal for unit record output. Input is limited to call number, author, title, and location codes. The data structure may not make much sense yet in this illustration, but note that repetitive data is not retyped, thus emulating keypunch operation. Duplication is controlled separately for each column by replacing the dashes, which define fields, with D's. This indicates that data in columns with D's are to be duplicated line by line until new data are entered in those columns. This set-up is simpler than preparing a keypunch to duplicate by making a program card and inserting it on the program drum. Set-up can be further simplified by storing the tab settings as a separate document which is fetched when required, and then simply matched on the keyboard.

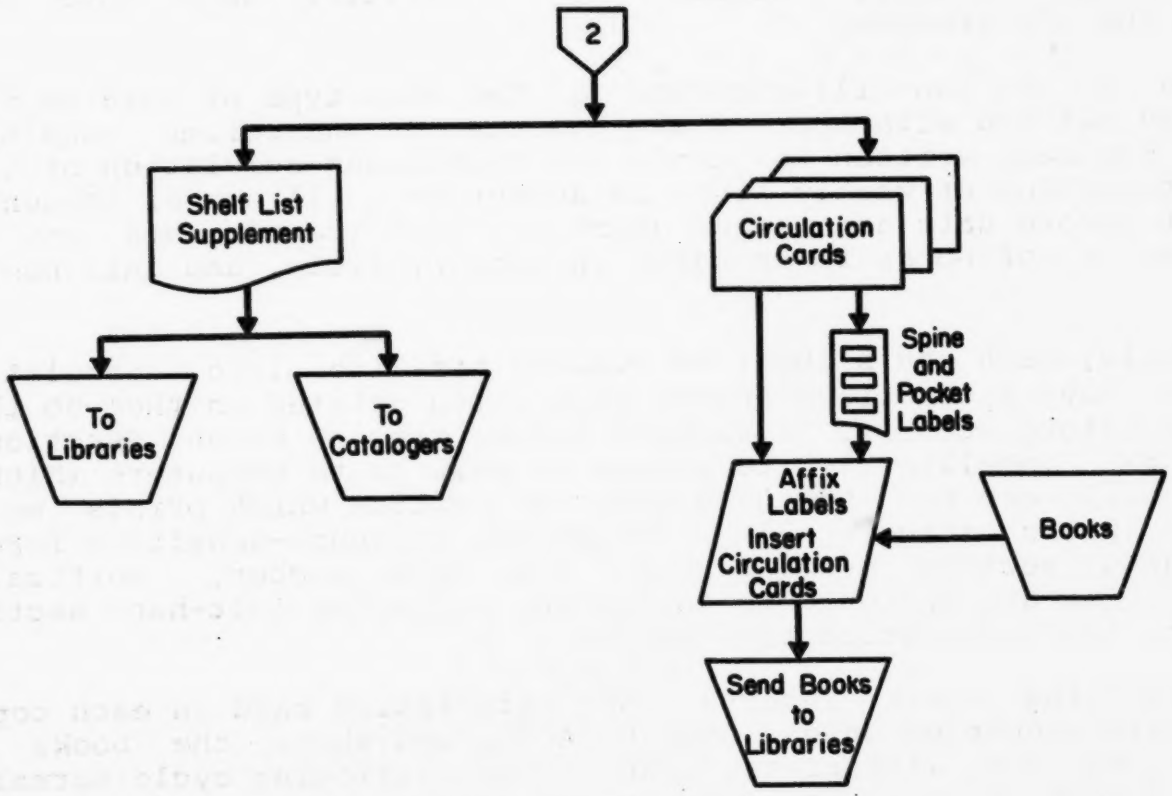

Figure 16. Book circulation and holdings records.

```
HD  21    B4   64      1BLUM A A              MANAG AND THE WHITE COLLAR UNIOP
TP 933    F8   64 1    1FEDERATION OF SOC FOINTRO TO COATINGS TECHNOLOGY    P
TP 935    F8   65 2    1FEDERATION OF SOC FOFORMATION AND STRUCTURE OF PAINP
QD  11    N3   65      1NAT RES COUNCIL       CHEM OPPORTUNITIES AND NEEDS   P
AG 521    D3   66      2DATA PROCESSING MANAAUDIO VISUAL AIDS FOR DATA PROCP
                       1                                                     P
HF5549T7  A5   65      1AMER MANAG ASSOC      MAKING THE MOST OF TRAINING OPPP
TR 2ØØ    M41  66      2MEES C E              THEORY OF THE PHOTO PROCESS    P
                       1                                                     P
                       1                                                     K
QA  76    C58364 4     2COMPUTING AND DATA PCOMPUTING AND DATA PROCESSING SP
                       1                                                     P
TK787Ø    V5   64      2VIDONI C M            RELIABILITY AND FAILURE OF ELECP
                       1                                                     P
QA  76    M33165       2MASS INST OF TECHNOLCOMPATIBLE TIME SHARING SYSTEM P
                       1                                                     P
                       1                                                     K
T   6ØW6  K31  66      2KARGER D W            ENGINEERED WORK MEASUREMENT    P
                       1                                                     P
                       1                                                     K
TR   9    F61  65 1    1FOCAL ENCYC OF PHOTOFOCAL ENCYC OF PHOTO             K
TR   9    F61  65 2    1                                                     K
TJ1189    C47  65      2CHILDS J J            PRIN OF NUMERICAL CONTROL      P
                       1                                                     P
                       1                                                     K
QA 611    M28  63      1MACLANE S             HOMOLOGY                       P
QA  297   H35  65      3HAWGOOD J             NUMERICAL METHODS IN ALGOL     P
                       2                                                     P
                       1                                                     P
```

Figure 17. Information typed on ATS to produce circulation cards.

Figure 18 is an illustration of the same type of data as they come from the off-line printer. Notice that repetitive data have been inserted by the ATS program.

Figure 19 is an illustration of the same type of data as they appear spaced out and with appropriate punctuation and column headings. A procedure has been written to permit the continuous cumulation of this data and production of weekly lists in author and call number sequence. All new unit record data are merged quarterly with the old data and an updated Catalog of Books is prepared in author, title, and call number sequences.

Meanwhile, each day's input is punched off-line into circulation cards which have appropriate format indication printed on them so that after proper interpretation, (a machine rather than a human function), the cards are intelligible to people as well as to computers (Figure 20). These cards are run through a computer routine which prints spine and pocket labels (Figure 21) on standard, pressure-sensitive forms. The right-hand section bearing only the call number, vertically arranged, is cut and fastened to the spine, while the left-hand section is affixed to the circulation card pocket.

The shipping clerk inserts the circulation card in each copy, enters the date processed on his copy of ADOL, and ships the books to the appropriate IBM libraries. The whole cataloging cycle normally takes about a week but has been done in one day, when required.

```
Q   141   A47 65 2    1AMER MEN OF SCIE     AMER MEN OF SCIE                P
Q   141   A47 65 2    1AMER MEN OF SCIE     AMER MEN OF SCIE                K
Q   148   U56 6Ø       2U S BUR OF LABOR STASCIENTISTS ENGIN AND TECHNICIANP
Q   171   C3  64 1    1CALDER N             WORLD IN 1984                   K
Q   171   C3  64 2    1CALDER N             WORLD IN 1984                   K
Q   184   I55 652Ø 4  2INSTRUMENT SOC OF AMANNUAL ISA CON PROC              P
Q   184   I55 652Ø 4  1INSTRUMENT SOC OF AMANNUAL ISA CON PROC              K
Q   184   I55 652Ø 3  2INSTRUMENT SOC OF AMANNUAL ISA CON PROC              P
Q   184   I55 652Ø 3  1INSTRUMENT SOC OF AMANNUAL ISA CON PROC              K
Q   184   I55 652Ø 2  2INSTRUMENT SOC OF AMANNUAL ISA CON PROC              P
Q   184   I55 652Ø 2  1INSTRUMENT SOC OF AMANNUAL ISA CON PROC              K
Q   184   I55 652Ø 1  2INSTRUMENT SOC OF AMANNUAL ISA CON PROC              P
Q   184   I55 652Ø 1  1INSTRUMENT SOC OF AMANNUAL ISA CON PROC              K
Q   185   S25 63      1SCIE INSTRUMENT MANUGUIDE TO INSTRUMENT DESIGN       K
Q   223   N35165      1NAT RES COUN         SCIE INFO ACTIVITIES OF THE NATK
Q   32Ø   C9  64 2    2CYBERNETIC SCIE SYMPBIOPHYSICS AND CYBERNETIC SYSTEK
Q   38Ø   R65 65      1ROWE H E             SIGNALS AND NOISE IN COMMUNICATK
QA    3   M56 65      1MITCHELL B           THEORY OF CATEGORIES            K
QA    3   U4  65 2    1U S ARMY MATH RES CEERROR IN DIGITAL COMPUTATION      K
QA   21   C24 64      1CARRUCCIO E          MATH AND LOGIC IN HISTORY AND IK
QA   21   S4  6Ø      1SCOTT J F            HISTORY OF MATH                 K
QA   37   H63 65      1HOCHSCHILD G         STRUCTURE OF LIE GROUPS         K
QA   37   M38 65      1MAXWELL E A          GATEWAY TO ABSTRACT MATH        K
QA   37   S48 65      1SHILOV G Y           MATH ANALYSIS A SPECIAL COURSE  K
QA   39   I53 65      2INTERN BUS MACHINES  MEASUREMENTS STANDARDS SEMINAR  K
QA   41   S83 64      2STEWART D G          GUIDE TO THE TYPING OF MATH NOTP
QA   43   T5  65      1TIETZE H             FAMOUS PROBLEMS OF MATH SOLVED  P
QA   43   T5  65      1TIETZE H             FAMOUS PROBLEMS OF MATH SOLVED  K
```

Figure 18. Circulation card data with information inserted by ATS program.

IBM SYSTEMS DEVELOPMENT DIVISION LIBRARIES BOOK HOLDINGS BY CALL NUMBER PAGE 6

CALL NO	DATE	V	PT	COP	AUTHOR	TITLE	LOC
BF 121. .J2	5ø	1		2	JAMES W	PRIN OF PSYCHOLOGY	P
BF 121. .J2	5ø	2		2	JAMES W	PRIN OF PSYCHOLOGY	P
BF 131. .F72	56			1	FRASER J M	PSYCHOLOGY	P
BF 131. .M715	56			1	MORGAN C T	INTRO TO PSYCHOLOGY	P
BF 131. .R84	53			1	RUCH F L	PSYCHOLOGY AND LIFE	P
BF 161. .O9	59			3	OVERSTREET H A	MATURE MIND	P
BF 181. .H4	49			2	HEBB D O	ORGANIZATION OF BEHAVIOR	P
BF 181. .H8	51			1	HUMPHREY G	THINKING AN INTRO TO ITS EXPERI	P
BF 181. .J4	51			2	JEFFRESS L A	CEREBRAL MECHANISMS IN BEHAVIOR	P
BF 181. .S8	51			2	STEVENS S S	HANDB OF EXPERIMENTAL PSYCHOLOG	P
BF 181. .W6	54			1	WOODWORTH R S	EXPERIMENTAL PSYCHOLOGY	P
BF 199. .B38	6ø			2	BERLYNE D E	CONFLICT AROUSAL AND CURIOSITY	P
BF 199. .W7	49			2	WRIGHT M	MANAGING YOURSELF	P
BF 2øø. .B5	61			1	BLUM G S	MODEL OF THE MIND	P
BF 2øø. .L3	64			2	LASHLEY K S	BRAIN MECHANISMS AND INTELLIGEN	P
BF 2ø3. .W45	45			2	WERTHEIMER M	PRODUCTIVE THINKING	P
BF 311. .D44	6ø			2	DEMBER W N	PSYCHOLOGY OF PERCEPTION	P
BF 311. .U5	66			2	UHR L	PATTERN RECOGNITION THEORY EXPE	P
BF 319. .C8	54			3	CURRENT TRENDS IN IN	CURRENT TRENDS IN INFO THEORY	P
BF 319. .H5	61			2	HILGARD E R	CONDITIONING AND LEARNING	P
BF 32ø. .W3	62			1	WATTS A W	JOYOUS COSMOLOGY	P
BF 321. .N5	57			4	NICHOLS R G	ARE YOU LISTENING	P
BF 335. .D8	49			2	DUNLAP K	HABITS THEIR MAKING AND UNMAKIN	P
BF 335. .S45	56			1	SHAFFER L F	PSYCHOLOGY OF ADJUSTMENT	P
BF 363. .R3	45			1	REILLY W J	LAW OF INTELLIGENT ACTION APPLI	P
BF 385. .L2	6ø			3	LAIRD D A	TECH FOR EFFICIENT REMEMBERING	P

Figure 19. Book holdings record -- shelf list (author and title lists not shown).

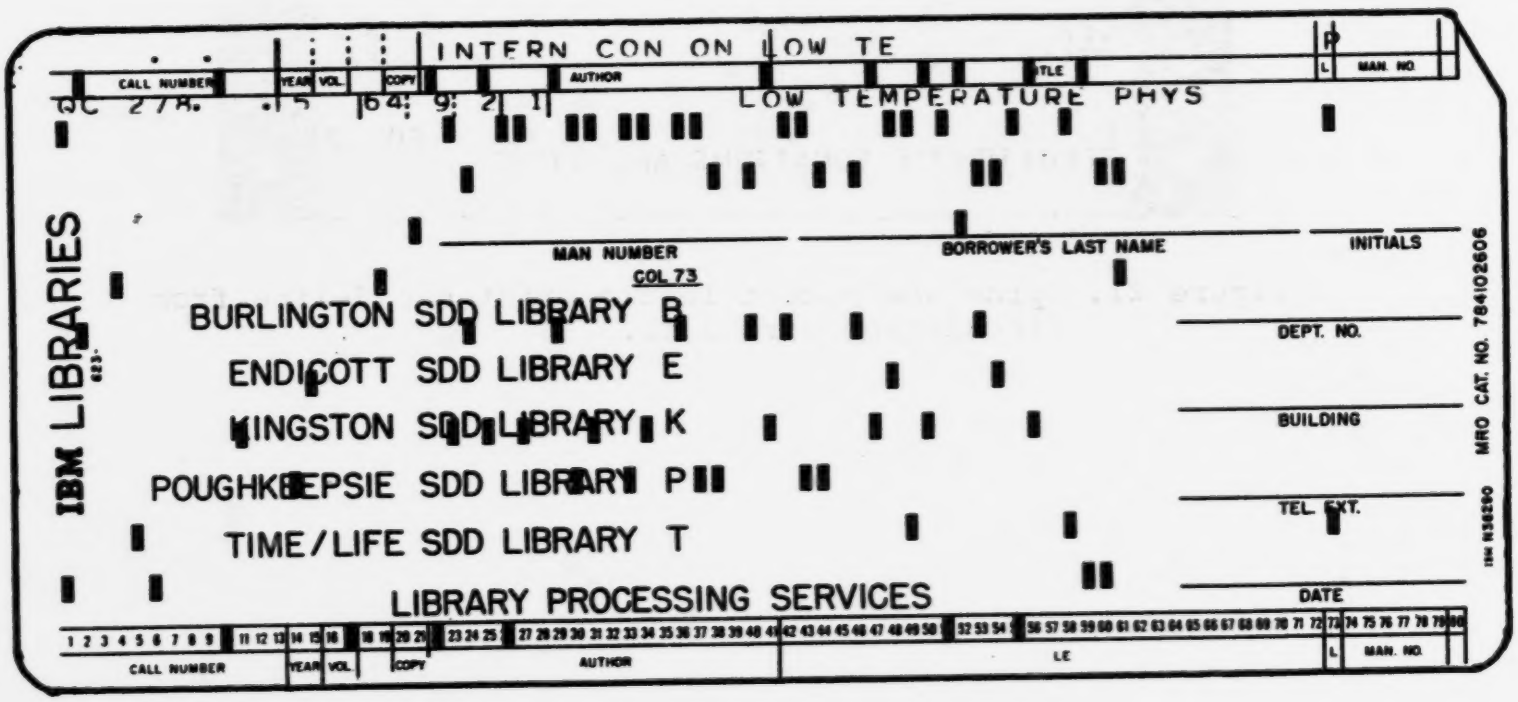

Figure 20. Book circulation card.

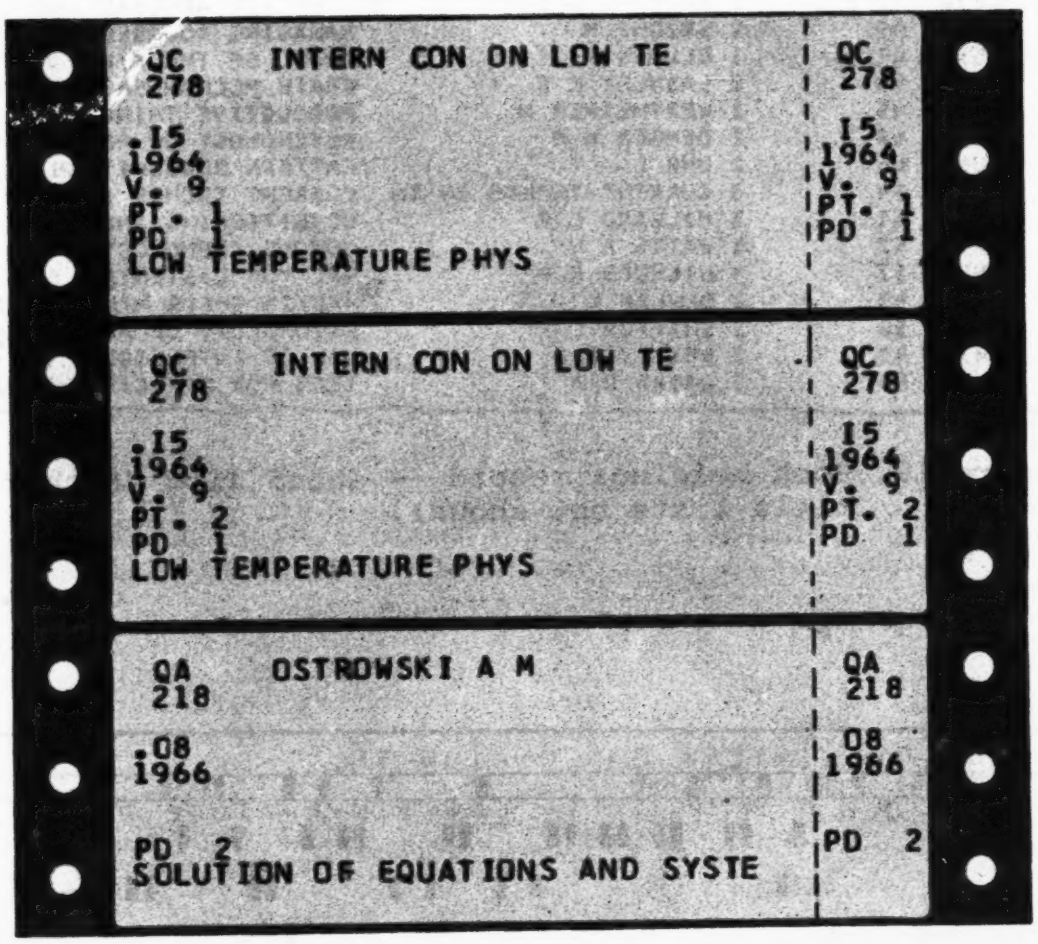

Figure 21. Spine and pocket labels printed off-line from circulation card data.

OTHER ATS LIBRARY APPLICATIONS

In addition to the library applications previously discussed, several other applications are currently operational or being planned. Among these are:

Master Subject Heading List

As its name indicates, this is a list of all subject headings approved for use by the catalogers. Form and style of entry is according to Library of Congress standards. Most of the subject headings are also derived from L.C. sources. Other headings have been added to suit the nature of our specialized collections but always in Library of Congress style.

Subject headings are entered in uncontrolled (U) mode to permit off-line data processing. Listings are run periodically and distributed to catalogers and reference librarians at the libraries served. Since input is entered in the proper alphabetic sequence from the catalogers' hand-annotated lists, no further processing is required. Errors are usually visually detected. This procedure replaces one where subject headings were maintained on punched cards, sorted and occasionally listed. The new operation is easier and takes less time.

Foreign Technical Document Translation

Translation of technical literature is normally a library responsibility. Use of ATS speeds the human as well as the computer translation process. ATS reduces the labor involved in making successive revisions by eliminating the need to retype the full text. Several translators are also able to work on the same document without any conflict. This application has been fully tested and found to be completely practical.

Operating Procedures

Similar to staff manuals but more detailed in describing systems operation, these are handled just like any text input and updating operation. Input mode depends on desired output. Uncontrolled (U) mode is chosen if frequent changes are anticipated; Automatic (A) mode creates a pleasing paragraph style with right and left margin justification, etc.

Proposals, Reports, General Correspondence

These applications make full use of the system's text processing capabilities. These documents are most often entered in "A" mode for the same reason as given above. Several lesser modes may also be used, such as the Heading (H), and Footing (F) modes. They are used to print repetitive headings and footings on subsequent pages of reports where their presence lends continuity -- page numbers may be inserted automatically, for example.

Periodicals

The area of periodical ordering, receiving, claiming, and binding preparation (not to mention periodical bibliographic control), is still in development. Rather than simply improving the process by use of the ATS, we decided the best course of action would be to create a system paralleling the book acquisitions and processing cycle, using more of the data processing capabilities of both the Administrative Terminal System and the library processing program package. Our goals are: ATS as the input device, computer-prepared orders, a fail-safe receiving procedure, automatic claiming of missing issues, binding slip preparation, continuously updated holdings records, and direct input to union lists of serial publications -- both for IBM libraries and for regional listings.

Selective Current Awareness Notification

Developments in selective information notification services have proceeded along several lines at IBM. The Systems Development Division's service called SCAN (Selective Current Awareness Notification), concentrates on periodical articles and other documents not covered by other IBM services. While fully computerized in the data processing aspects of the cycle, the process would benefit from the addition of terminals as input/output devices, similar to the book processing operation. Also, integration of several such services within IBM appears feasible with ATS used as the communications device.

ATS APPLICATIONS OUTSIDE THE LIBRARY

The Administrative Terminal System is basically a highly versatile computer system. As such, its capabilities need not be limited to library and information processing applications. Then too, the optimum number of terminals the system can accommodate is greater than the number of terminals required by any but the largest libraries or technical information centers.

Present applications, as well as those being developed make ATS increasingly attractive to nonlibrary areas, a highly significant factor to librarians who often cannot justify data processing installations solely for the library and must rely on mutual support from other functions on campus or in the company. Some of these other applications which have been, or are being, developed in SDD Poughkeepsie are:

Patent Operations

Only output, such as patents, invention disclosures, and decisions of invention disclosure review boards, is available presently for machine-based searching and retrieval. A current study seeks to integrate the entire patent operations cycle into a computer-based search and retrieval system by having all patents-related documents typed on the ATS. Meanwhile, preparation of the above-mentioned documents has been materially assisted by employing the text processing abilities of ATS.

Plans and Controls

This function is responsible for project planning and control processes which measure performance against plans. It also issues status reports on the progress of systems designs at various IBM laboratories. Control files are maintained on a real-time basis and are accessible to those persons requiring this information. Manpower and costs have been reduced in the preparation of control documents and specifications, while at the same time accuracy has increased significantly.

Engineering Design Services

Continuously updated status reports on engineering changes made during the course of computer systems development have been made possible through the use of ATS. Systems installation instructions are also written by this group and updated as design changes warrant.

Engineering Proposals

Very much like contract proposals, engineering proposals are IBM's answer to customers who wish special features installed on computer systems. Proposals are composed of roughly 75% standard text and 25% specialized text aimed at the specific application. The ability of ATS to edit and manipulate data in an almost limitless combination of formats and sequences makes it ideally suited to these specialized text-writing applications.

Systems and Procedures Manuals

Since these documents are changed as often as necessary to meet changed conditions, ATS has spared systems and procedures analysts and their typists from a high volume of needlessly repetitive rewriting and retyping. The system's communications capabilities are also employed to rapidly disseminate new procedures.

SUMMARY

The IBM Administrative Terminal System has been in use for almost two years in library processing applications outlined in this paper. While no special programs were written for these applications, the system's flexibility allowed us to continue using the program package previously developed. At the same time we adopted the advantages of an on-line, real-time terminal system. ATS enables us to improve library service through faster, more accurate response, full documentation, on-line document retrieval, and data communication. ATS applications result in cost savings over manual typing and keypunching. Other library applications are in effect or are being developed. Librarians should consider and suggest nonlibrary applications for their company or institution to support their own interest in terminal systems.

ACKNOWLEDGMENT

ATS was designed and developed at IBM's Advanced Systems Development Division, San Jose, California. Mr. Michael Nekora was principally responsible for the design, development and implementation of the basic ATS program. The library processing program package for the IBM 1401 Data Processing System was designed and developed at the IBM Systems Development Division Laboratories at Kingston and Poughkeepsie, New York. Messrs. Kenneth E. Sorrel and Dean Stewart wrote this series of programs.

BIBLIOGRAPHY

The following publications or articles are devoted wholly to the IBM Administrative Terminal System. Papers dealing generally with on-line, real-time terminal systems have not been included even if they might have discussed library applications or mentioned ATS.

1. G. F. Duffy, W. D. Timberlake, "A Business-Oriented Time-Sharing System," American Federation of Information Processing Societies, AFIPS Conference Proceedings, Vol. 28, 1966, Spring Joint Computer Conference, Washington, D.C., Spartan Books, 1966, pp. 265-275; IBM Corp., Systems Development Division, TR 00.1374, December 13, 1965, Poughkeepsie, N.Y.

2. R. M. Hayes, "The Concept of an On-Line, Total Library System," Library Technology Reports, May, 1965.

3. M. R. Nekora, "Program Design in the Administrative Terminal System," IBM Corp., Advanced Systems Development Division, Technical Report 16.123, April 30, 1965, Los Gatos, Calif.

4. M. R. Nekora, "A User-Oriented Approach to Terminal Systems," IBM Corp., Advanced Systems Development Division, Laboratory Memorandum ASDJ-M-093, November 23, 1965, Los Gatos, Calif.

5. The IBM Administrative Terminal System, Form #520-1146, IBM Corp., Data Processing Division, White Plains, N. Y.

6. 1440/1460 Administrative Terminal System Application Description, Form #H20-0129-1, IBM Corp., Data Processing Division, White Plains, N. Y.

7. 1440/1460 Administrative Terminal System Console Operator's Manual, Form #H20-0227-0, IBM Corp., Data Processing Division, White Plains, N.Y.

8. 1440/1460 Administrative Terminal System Programmer's Manual, Form #H20-0228-0, IBM Corp., Data Processing Division, White Plains, N. Y.

9. 1440/1460 Administrative Terminal System (1440-CX-07X) Terminal Operator's Manual, Form #H20-0185-1, IBM Corp., Data Processing Division, White Plains, N. Y.

APPENDIX A

Administrative Terminal System
Library Processing Flowcharts

The flowcharts in this section diagram several library processing operations discussed in the text of the report. This new method of flowcharting was devised to present data flow in the Administrative Terminal System more accurately than conventional flowcharting would have permitted.

On each chart, separate columns indicate operations performed in the system (1) on the terminal keyboard; (2) in working storage; (3) in permanent storage; (4) on peripheral computer equipment; and (5) external to the computer system. Standard flowcharting symbols are used throughout. While the sequence of events normally occurs from top to bottom, data flow may be in any direction, and is indicated by arrows. External operations occur in their indicated time sequence but are unconnected by arrows to show that there is no direct data transfer.

Letters in the request columns are not only single-letter mnemonics representing the functions performed, but are, in fact, the signals used by ATS to cause the computer operations to occur.

Mnemonic	Operations
C	Clears working storage.
D	Deletes a document in permanent storage.
E	Erases specific data in working storage.
G	Gets a document located in permanent storage and places a copy of it in working storage.
I	Inserts data in a document in working storage.
P	Prints contents of working storage on the terminal.
R	Reprints the last page printed. May be used instead of P.
S	Stores a document now in working storage in permanent storage.
T	Transmits data to a specific terminal (indicated by its number).
U	Uncontrolled Mode (i.e., uncontrolled by any formatting rules).

Only those instructions shown on the charts are indicated here. The full instruction set may be seen in the terminal operator's manual.

("EX" is merely an indication that the operation is occuring external to the system; it is not an instruction.)

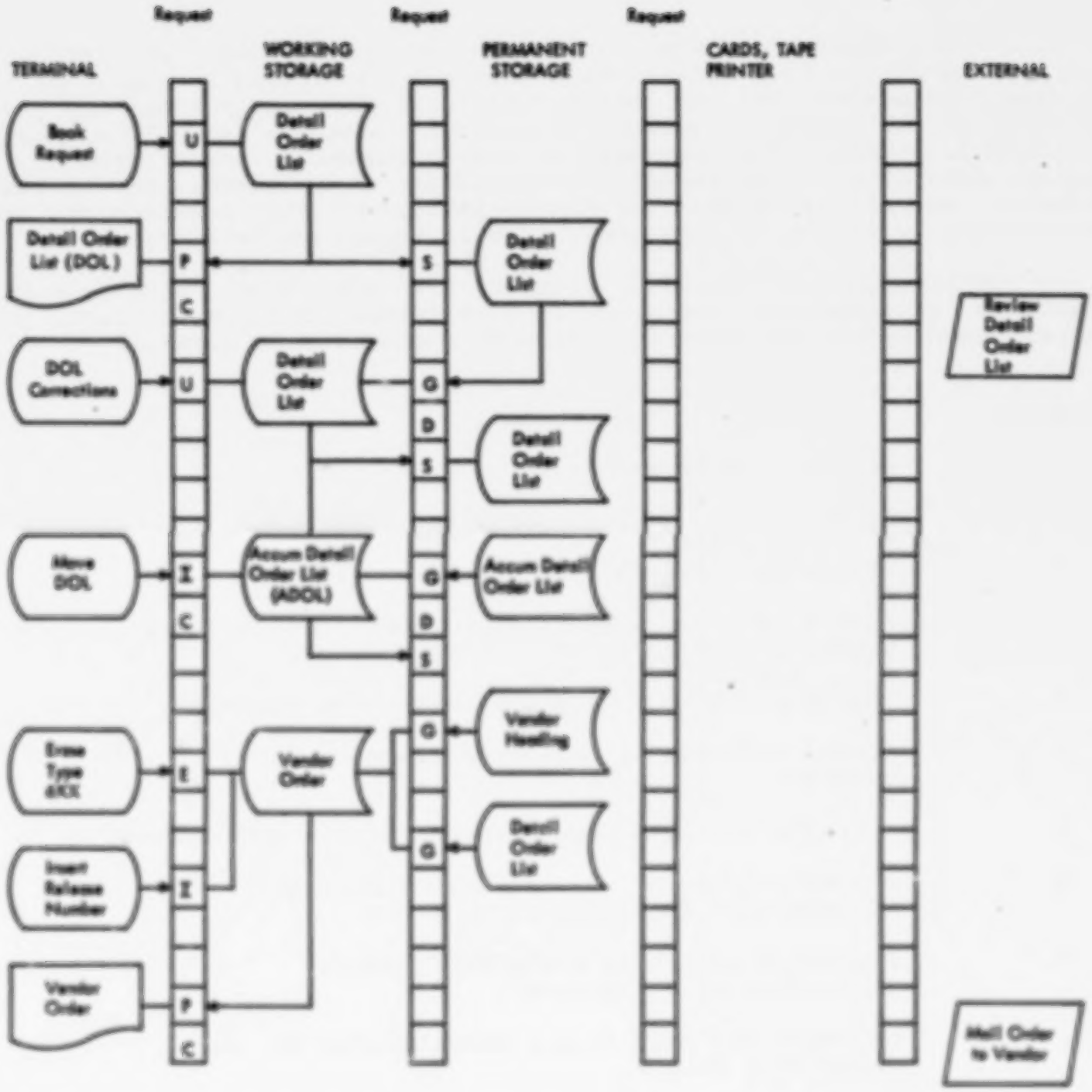

Figure A-1. Single-terminal book ordering procedure (5/7/65).

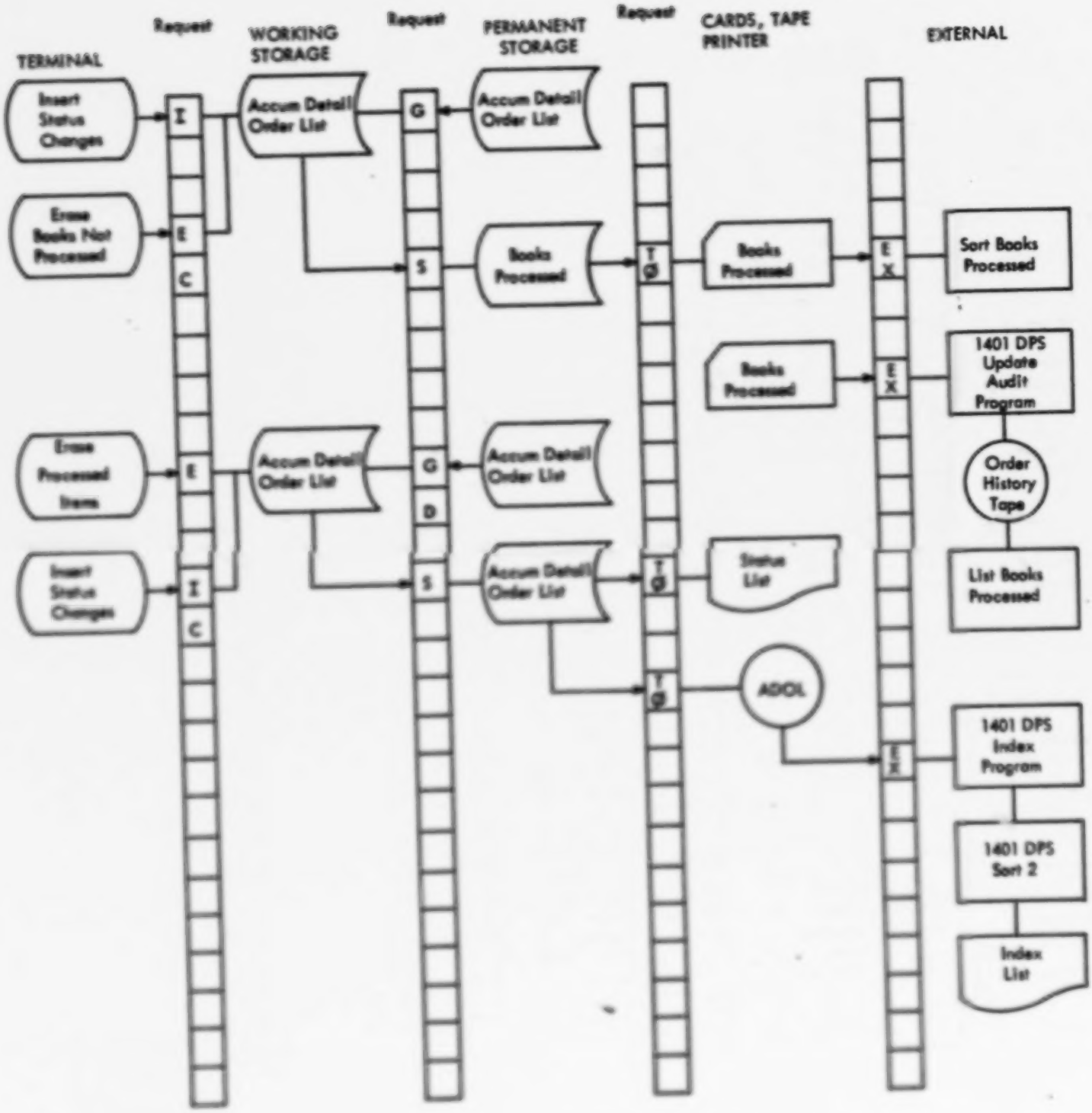

Figure A-1. Continued.

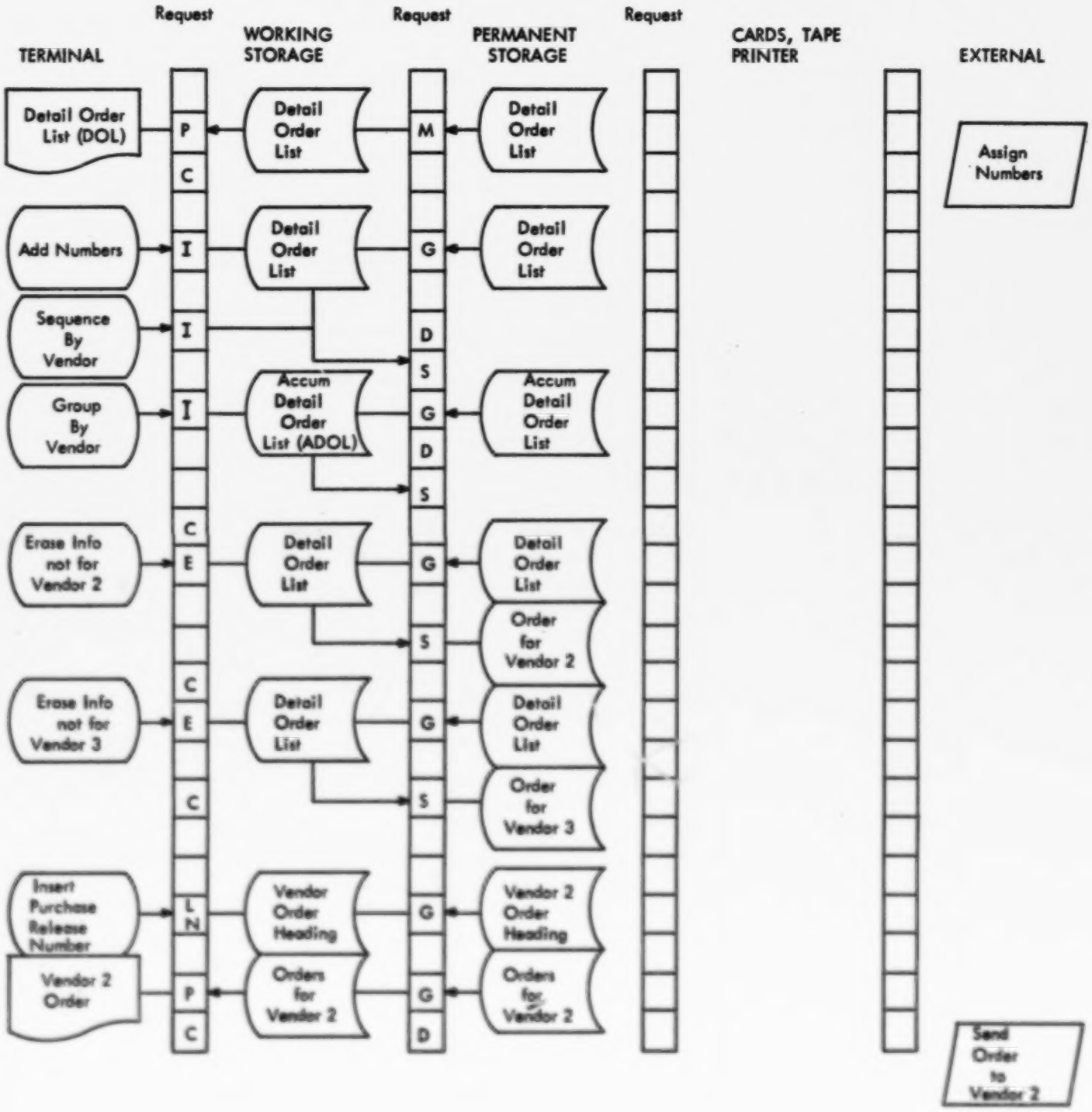

Figure A-2. Multiterminal book ordering procedure -- central processing terminal (4/27/65).

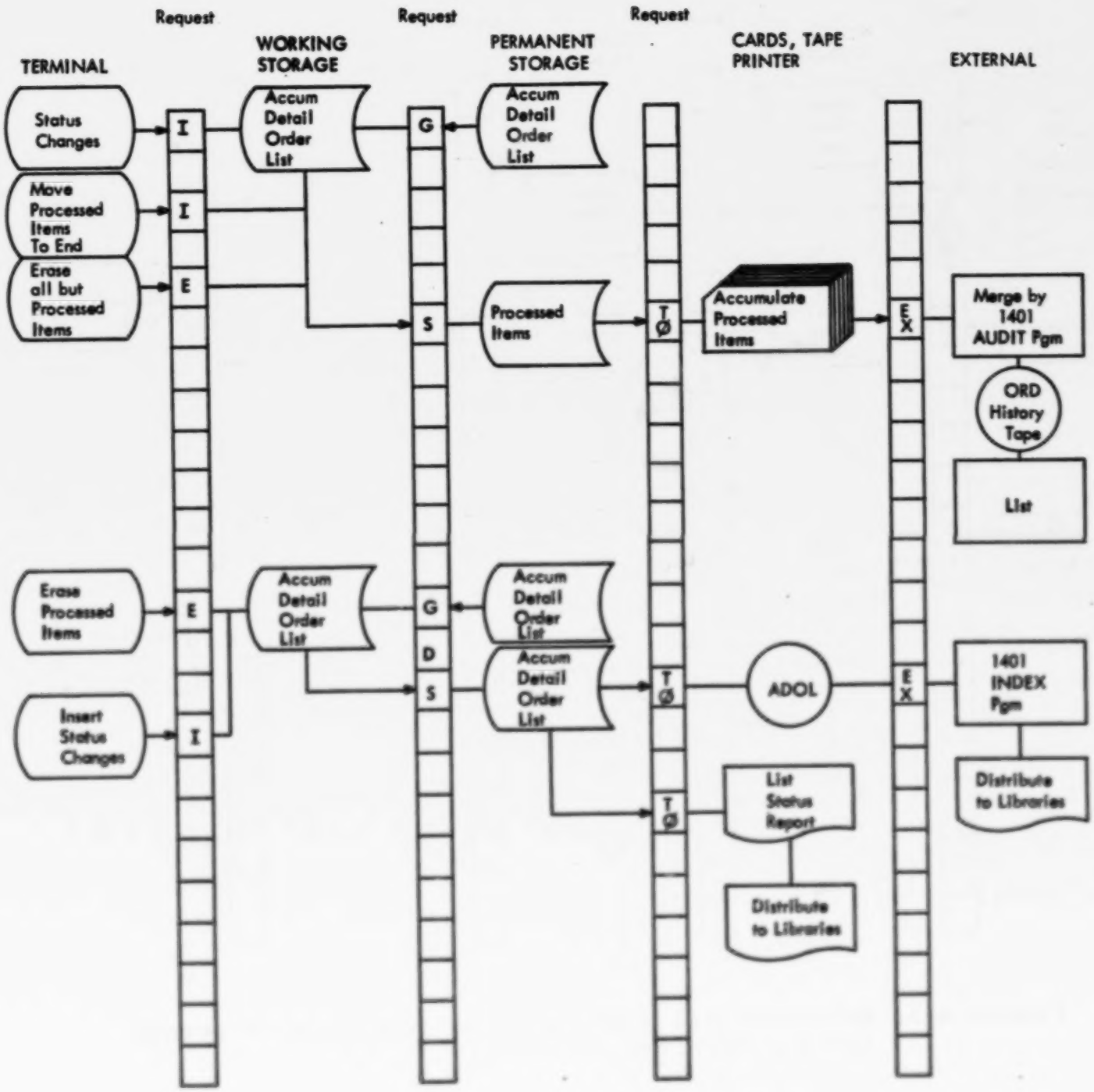

Figure A-2. Continued.

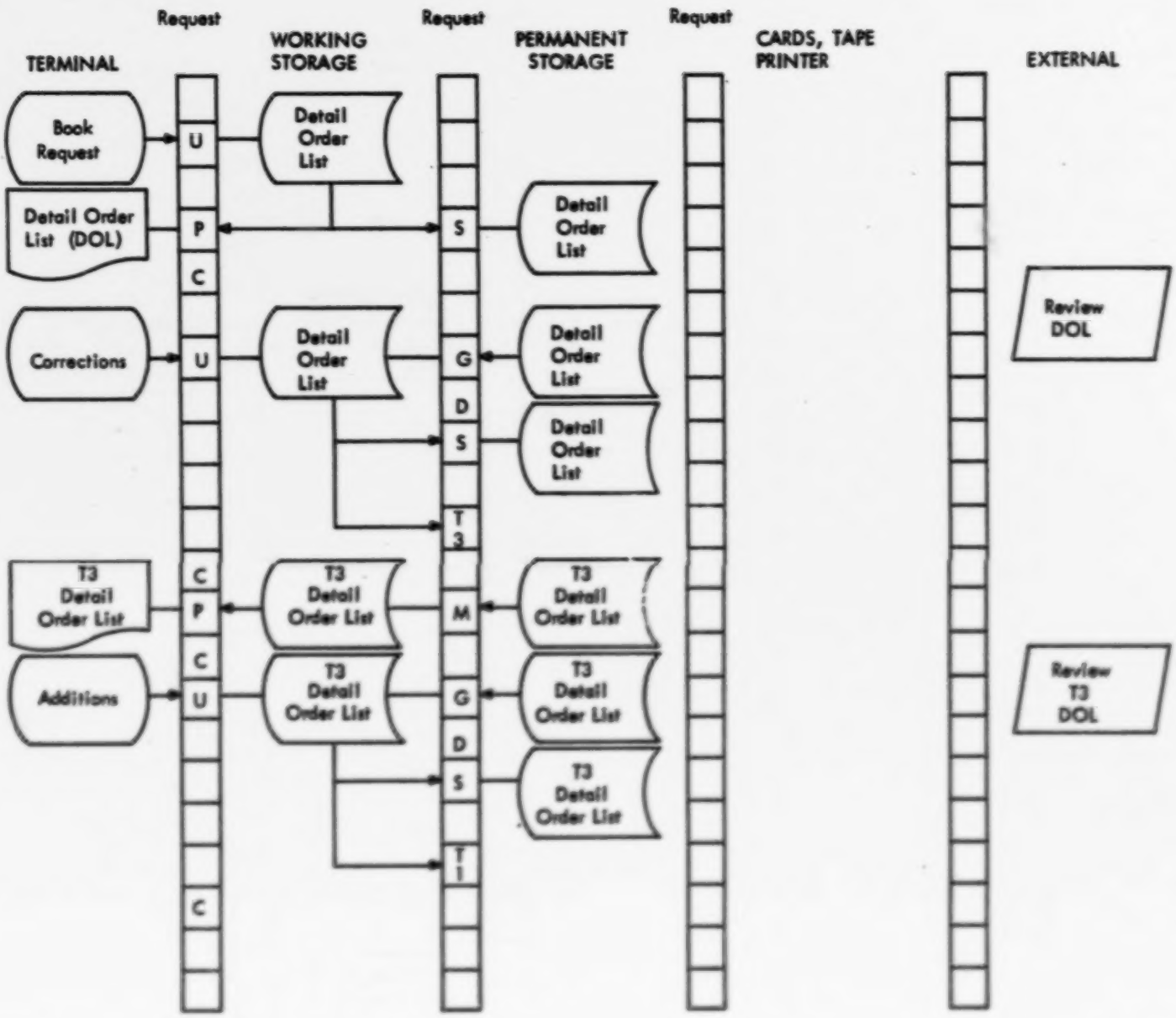

Figure A-3. Multiterminal book ordering procedure -- remote library terminal (4/27/65).

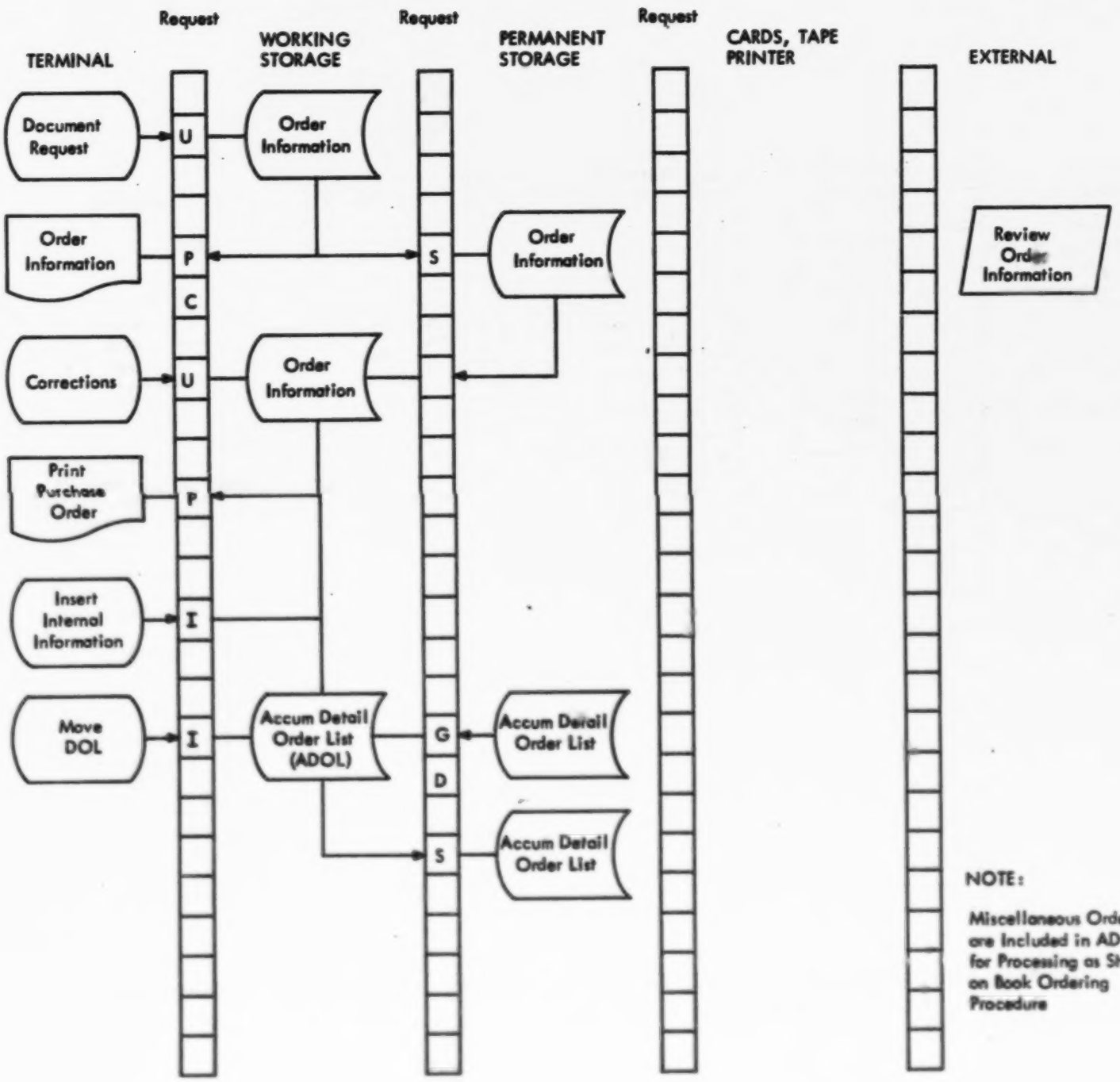

Figure A-4. Single and multilibrary miscellaneous document ordering procedure (5/7/65).

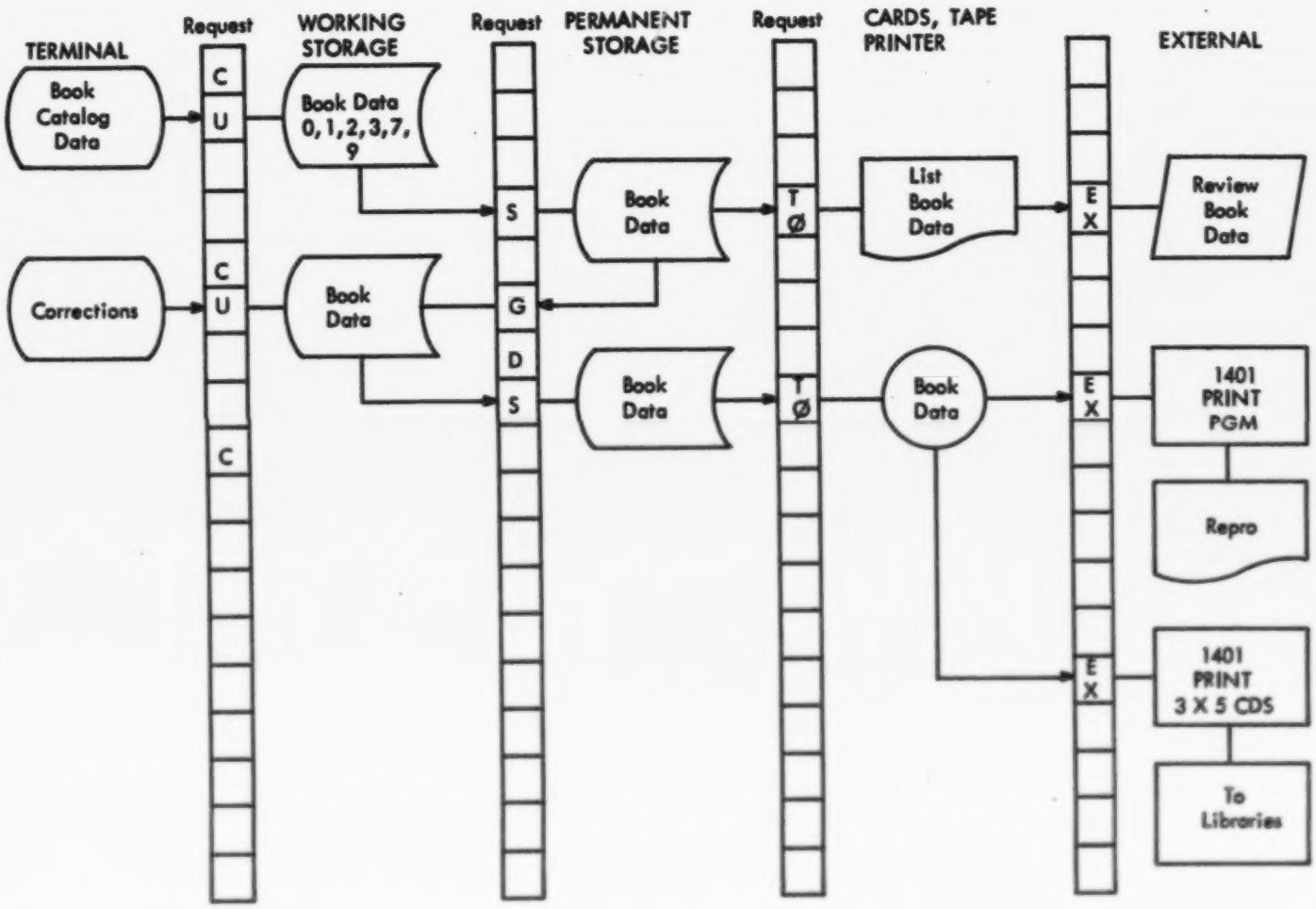

Figure A-5. Single and multilibrary book cataloging procedure (5/10/65).

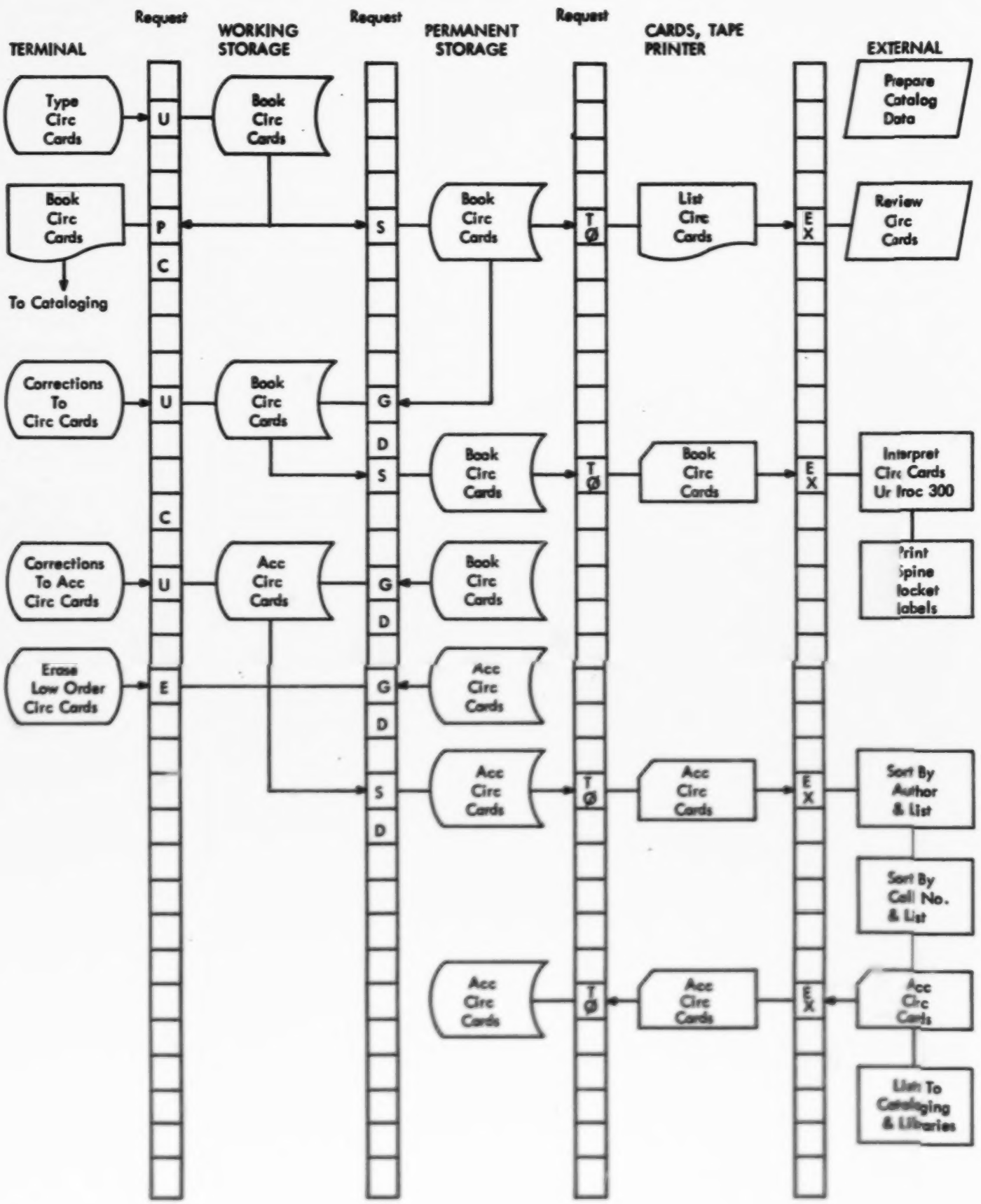

Figure A-6. Unit record cataloging control (circulation cards, spine and pocket labels, cataloging control listings) (1/18/66).

APPENDIX B

Information Processing Data Format

Format of the data to be typed for book and document processing is described below. Data is typed in the Uncontrolled mode, one entry per line. Because the data will be converted to cards and magnetic tape and processed by various programs of the library program package, as well as by the Administrative Terminal System, it is grouped into significant fields in each line.

Columns (Typing Positions)	Field
1-46	Data
61-72	Book or item number
73-75	Data type and sequence

Book or Item Number coding is as follows:

Columns (Typing Positions)	Field
61-62	Cataloging location
63-64	Vendor supplying item
65-66	Technical category
67	Last digit of year (1966)
68-69	Week number (01-52)
70-72	Sequence number within week (001-999)

Technical category, columns 65-66, is chosen from a group of digits assigned on the basis of subject content; e.g., 01 Aerospace, 02 Components, etc. Categories are usually not assigned until the item is received and are used solely to group items for notification and announcement; e.g., in the library bulletins.

Data Type and Sequence coding is as follows:

Column 73 indicates the data type, and column 74, the subtype. Columns 73-75 also indicate record (line) sequence within type. Type assignments are as follows:

Columns 73-75	Type
001	Item number
010	Shelf key
101,102,103,etc.	Personal authors
111-119,121-129,etc.	Corporate authors
201-	Title of book
251-	Series titles
301-	Notes (series, general, etc.)
351-	Publisher
401-	Quantity, price, vendor data
601-	Internal information, accounting data
701,702,703,etc.	Subject heading(s)
801-	Order status
9XX-	Holding library

Usually, all types of data will not be typed at one time. Type 8XX records will be typed as status changes. 010, 7XX and 9XX will be typed after book is received, unless this information is available at the time of order or added as a result of parallel cataloging. Type 001, 4XX, 6XX and 8XX are used for ordering only and never become part of cataloging data.

General Rules for All Types

1. Data should not exceed column 46 in any line and should end in a whole word. A normal hyphenated word may be broken if there is at least one blank space after the hyphen in the data field.

2. Type the book number (cols. 61-72) in the first (001 or 010) record only.

3. Use the following substitutions for punctuation marks:

For	Use
Parentheses, brackets	Slash (/)
Colon	Period (.)
Semicolon	Period (.)
Question mark	Space
Exclamation mark	Space
Apostrophe	Space
Quotation	Space

Rules for Specific Card Types

Type 001	Item Number
Cols. 1-6	Item Number
Col. 7	Blank Space
Cols. 8-14	RELEASE
Col. 15	Blank Space
Cols. 16-17	Release Number
Cols. 61-72	Book Number
Cols. 73-75	001

Type 010	Shelf Key
Cols. 1-15	Shelf key Period (.) in col. 7 Period (.) in col. 11
Cols. 16-21	Year of publication in slashes, as /1966/
Col. 28	Hyphen (-) (only when shelf key differs from number assigned by Library of Congress)
Cols. 73-75	010

Type 101	**Personal Authors**
Type only one personal author per line.	
Cols. 1-46	Last name, comma (,), space, first name or initial, space, middle name or initial. If Translator, Editor, Junior, etc., are used, follow the last initial with a space then the term /TR/, /ED/, or /JR/. Include the slashes.
Cols. 73-75	101 (First author) 102 (Second author)etc. Limit: 9 personal authors
Type 111	**Corporate Authors**
Cols. 1-46	(First line for each author.)
Cols. 4-46	(Second and succeeding lines for each author.)
Cols. 73-75	111 (First line of first corp. author) 112 (Second line of first corp. author), etc. 121 (First line of second corp. author) 122 (Second line of second corp. author), etc. Limit: 9 corporate authors
Type 201	**Title**
Cols. 3-46	First line of Title
Cols. 1-46	Second and succeeding lines of title. End title with a period, number sign and two spaces. P period (P.) are typed as part of page count with no intervening space.
Cols. 73-75	201,202, etc.
Type 251	**Series Title**
Cols. 1-46	Do not exceed col. 46 Type series title only if Type 251 is marked. No punctuation at the end of series title. Second and succeeding lines are typed in columns 1-46.
Cols. 73-75	251, 252, etc. This category also may be used for added title.
Type 301	**Notes, Etc.**
Cols. 1-46	Type only information identified as Type 301.
Cols. 73-75	301, 302, etc.

Type 351	Publisher
Cols. 1-4	Year of publication (if not shown, leave blank on order. Never left blank in cataloging data.)
Col. 5	Comma (,)
Col. 6	Blank
Cols. 7-46	Name of publisher, comma (,), blank, location of publisher. (City, and state where necessary.)
Cols. 73-75	351, 325, etc.

Type 401	Quantity
Cols. 1-8	QUANTITY
Col. 9	Blank
Cols. 10-11	Number of copies (two digits)
Cols. 18-19	AT
Col. 21	Blank
Col. 21	Dollar sign ($)
Cols. 22-25	Dollar amount right justified
Col. 26	Period. (decimal point)
Cols. 27-28	Cents amount right justified with preceding zero
Cols. 73-75	401

Type 601	Internal Information
Cols. 1-46	Type as shown
Cols. 73-75	601, 602, etc. Accounting data, one line per dept. and account number, borrower information, and special instructions regarding disposition of material on receipt.

Type 701	Subject Headings
Cols. 1-46	Type as shown, one subject per line, following rules for entering subject headings. Should not exceed col. 46.
Cols. 73-75	701 (First subject) 702 (Second subject), etc.

Type 801	Order Status
Cols. 1-3	REC Entered on date received
Col. 4	Blank
Cols. 5-10	MMDDYY (Date in digits, as 043166)
Cols. 11-12	Blank
Cols. 13-16	PROC Entered on date processed
Cols. 17-18	Blank
Cols. 19-24	MMDDYY (Date in digits as 050466)
Cols. 73-75	801

Type 9XX	Holding Libraries
	Type one line for each library holding a copy of book or document.
Cols. 1-3	9XX (Identifying code for library; one has been assigned to each IBM library.)
Cols. 13-27	Library of Congress Call No. Decimal point in col. 19 Decimal point in col. 23
Cols. 28-33	/Year of publication/ in digits between slashes, as /1966/
Cols. 73-75	9XX (Library code) Same as data in cols. 1-3 for each entry.